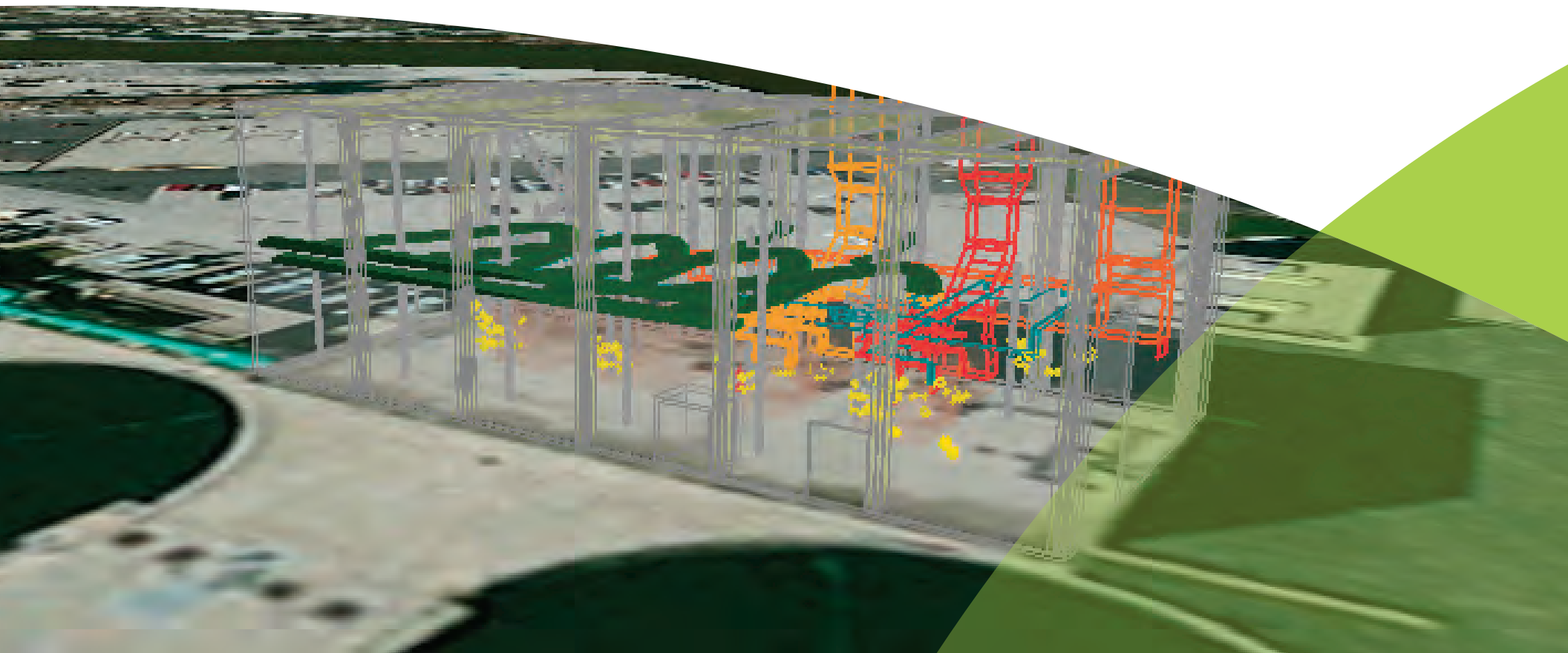


February 2014

# Facilitating Municipal Workflows

GIS for Public Works, Vol 3



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# Introduction

Public works is often viewed as the unseen facilitator of municipal government. It is the department that makes sure that the city is running smoothly, and the American Public Works Association (APWA) calls the men and women of public works "everyday heroes." Ranging from roadway maintenance to public park inventories, the department faces daily challenges such as crew safety, government mandate compliance, traffic sign replacement, and service vehicle routing. Frequently, a public works department finds it is using multiple IT systems to manage its disparate workload.

However, an increasing number of departments have come to rely on a geographic information system (GIS) platform to integrate their dissimilar systems because of its ability to provide a common, geoenabled view of their entire enterprise. With its geodata referencing, management, and analytical tools, GIS optimizes the workflow common to most public works departments.

The municipal workflow includes asset information, planning and analysis, field mobility, operational awareness, and citizen engagement. The resultant synergy supports a dynamic system that allows the public works department to function smoothly across its full range of responsibilities including roadway inventories, facilities maintenance, water system optimization, solid waste disposal, fleet management, unfunded mandate compliance, and public park conservation.

# Asset Information

A public works information system based on the ArcGIS platform streamlines an organization's workflow because it can integrate many applications such as asset and work order management, routing, traffic analysis, and accounting. Managing the physical asset inventory is the foundation of any public works department. Sharing this data throughout the organization saves time and money while increasing efficiency and productivity.

# Philadelphia Saves \$1 Million per Year

## GIS-Based Traffic Light Project

Jim Baumann, Esri

The City of Philadelphia, Pennsylvania, is using ArcGIS software to implement its LED Traffic Lights Project, an ambitious traffic light replacement program funded in part by an American Recovery and Reinvestment Act of 2009 grant. With ArcGIS, the city's Department of Streets will track and manage the project, which will replace 87,000 incandescent light bulbs with energy-saving light-emitting diode (LED) bulbs. Estimated operational savings, resulting from significantly lower use of electricity, the greater longevity of LED bulbs, and the fixed department costs to replace bulbs, are expected to top \$1 million per year.



The Liberty Bell in Philadelphia, Pennsylvania.

In addition to saving money and field personnel time, Philadelphia's enterprise implementation of the system provides data access to other departments within the city, resulting in a significant return on investment.

Andy Mehos, GIS manager for the Department of Streets, says, "The opportunity to capture the asset data for the light replacement project, use it for other applications within the Department of Streets, and share it with other departments saves the city a considerable amount of time and money. It is significant enough to offset any cost of software development and the purchase of equipment. After observing our success in implementing this project, other city departments are considering similar GIS projects of their own."

The department employed Esri Partner geographIT to develop a customized GIS application integrated with ArcGIS that supplies a spatially enabled mobile solution for tracking street-related city assets. The application's bar code scanning capability provides a quick way to add an LED bulb record to the geodatabase while in the field. In addition to LED bulbs, the department is capturing asset data about traffic heads, traffic control boxes, and light and sign pole attachments with the application.

A video about Philadelphia's light replacement program, *The Recovery Act Is "Lighting Up" the Streets of Philadelphia*, can be seen at [esriurl.com/1726](http://esriurl.com/1726).

For more information about Esri's public works solutions, visit [esri.com/publicworks](http://esri.com/publicworks).

(This article originally appeared in the Spring 2011 issue of *ArcNews*.)

# Utility Saves Money by Mapping Street and Security Lights

Josh Snoddy, GIS Coordinator, Holy Cross Energy

Holy Cross Energy, an electric cooperative in western Colorado, used GIS technology to help update and correct its billing system for the cost of street and security lighting—a move that is saving the utility and some of its customers hundreds of dollars per month.

A member-owned cooperative founded in 1939, [Holy Cross Energy](#) serves more than 55,000 meters in communities such as Vail, Aspen, and Beaver Creek.

The utility's security and streetlight project involved digitally mapping security lights and streetlights within its service area using GPS, aerial photographs, and a custom web mapping application powered by Esri's ArcGIS platform. The project started in May 2010 after Holy Cross Energy staff determined that the utility's maps needed to be updated with the exact location of street and security lights. Staff started with various levels of information in its billing system and incorrect or missing map information.

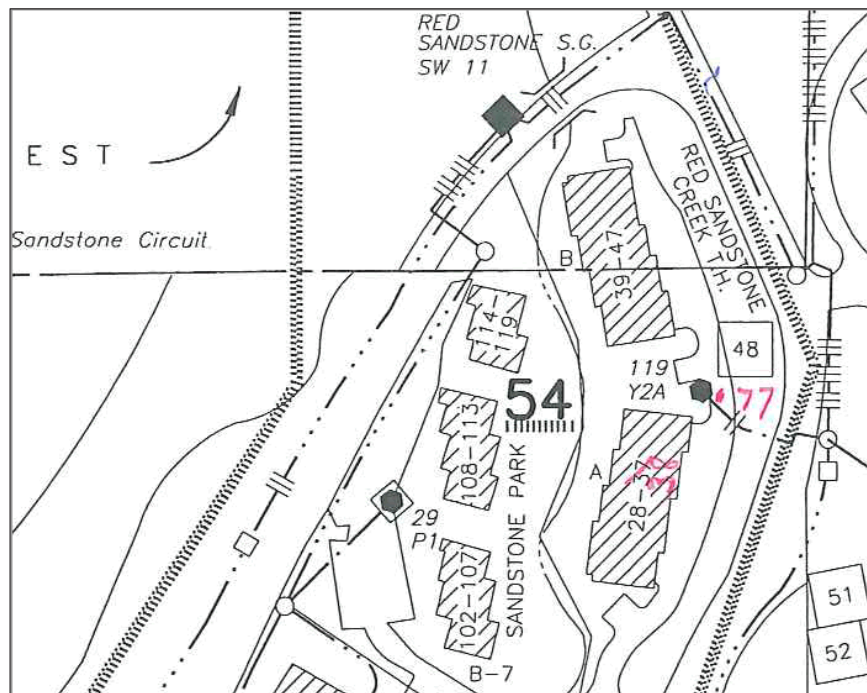
First, the utility sent crews into the field to collect the exact GPS location for each streetlight.

In the past, the locations of street and security lights were created without GPS points. Some streetlight locations were created in previous CAD programs. In other cases, the location of a streetlight was entered into the GIS based on proximity to the billing address on file. Some security lights in rural areas, such as county roads, were not shown at all.



Holy Cross Energy's mapping application shows where lights were added in an area.

Meter supervisor Tonya Warmenhoven started the security and streetlight project by going into the field with a laptop that was loaded with software, including a custom map, from Esri and Esri partner Futura. During her on-site evaluation, she was able to find lights according to GPS location and mark the locations on paper maps. Later in the project, the utility's GIS team created a web application to make paper maps unnecessary. Some regions of the project area did not rely on GPS points because the aerial



One of the utility's old paper maps shows the same area, with streetlights noticeably missing.

images provided enough detail. In those cases, Warmenhoven e-mailed the GIS analyst marked-up screen shots of areas. The GIS analyst, in turn, placed points into ArcGIS according to the sketch.

As the project progressed, Holy Cross graduated to using ArcGIS for Server with a custom web editing application. Warmenhoven could then enter all the data herself, eliminating the steps of marking paper maps and e-mailing updates to the GIS analyst. Using the web editing application, Warmenhoven could edit the light features only to ensure that she did not inadvertently update another feature. She was pleased to have complete control over editing the light features with a next-day turnaround of the data for everyone in the company.

Meter supervisors can now update the GIS and complete their work faster, as the updates do not have to be made by the GIS analyst. In an upgrade to the initial project process, Holy Cross has eliminated the process of marking up paper maps and sending them to the GIS analyst. All edits can be made through the web application hosted at the company's main office in Glenwood Springs. This only requires access to a web browser at the satellite office where Warmenhoven works. The new process saves Holy Cross four labor hours each week.



The updated information has helped to improve accuracy in the utility's billing system by ensuring that all street and security lights are properly accounted for and billed. Throughout the utility's service area, towns and subdivisions have benefited from the cleanup of streetlight data and accounting.

"We have saved \$442 per month for one of the towns we serve, as they were paying for devices that no longer existed and were paying for higher wattage bulbs than they should have been," Warmenhoven said. "An association in our service area, on the other hand, had been getting free power for its streetlights and lighted address markers for at least 10 years. They are now billed \$600 per month for 178 new devices we have added."

Holy Cross Energy has benefited by having correct information to provide to its consumers and its billing department. Service and billing personnel now have precise data about devices in the field. In the past, field crews would have had to call the billing department to get information about street and security lights. Now they have access to that data via laptops in the line trucks.

(This article originally appeared in the September 2012 issue of *ArcWatch*.)

# GIS Puts Culver City Sewer Maps in Their Proper Place

Updated Maps Are Now Available Online to Engineers, Contractors, and the General Public

Jessica Wyland, Esri

Harry H. Culver started making plans in 1913 for the city that carries his name. Culver City, California, incorporated in 1917, lies halfway between the cities of Los Angeles and Venice. Buoyed by a strong economic base of movie studios, small businesses, and industrial endeavors, the city grew to include more people, more



Culver City, California, circa 1920.

land, and schools. By 2000, the city had quadrupled in size and is now a community of nearly 40,000 residents.

The effects of time and growth compromised Culver City's public works data, especially the city sewer system. When Marcos Mendez started work in 2007 at the Culver City Information Technology Department, he began to collaborate with the Public Works Department to update citywide sewer maps. The city needed a current record of its assets for maintenance and inspection. Mendez used geographic information system (GIS) technology from Esri for the project to create an asset database and to provide online maps of the city's sewer system to contractors, city engineers, and the general public.

## Compiling Sewer Plans

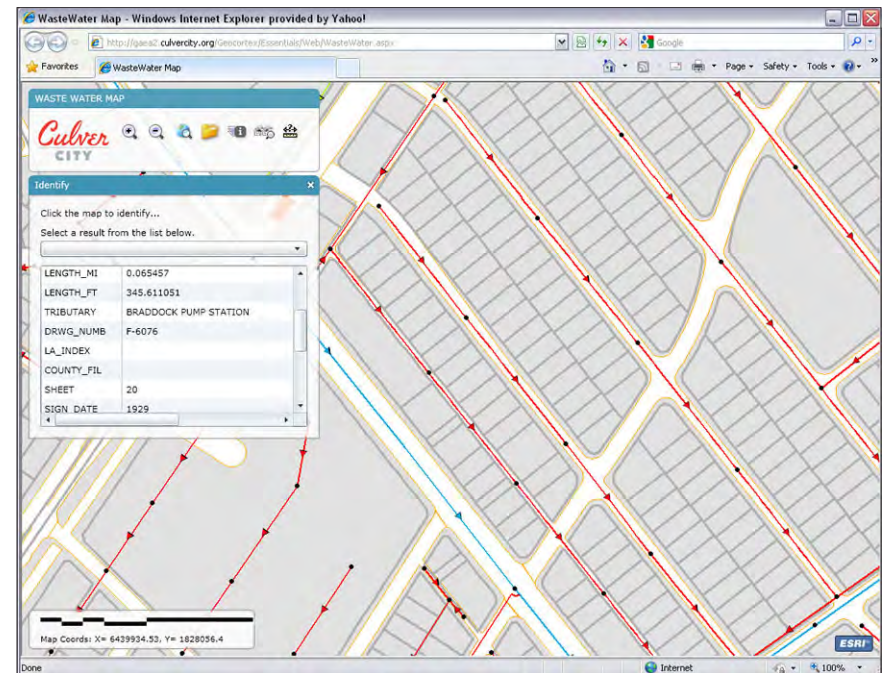
Mendez began the process by looking at all the city's sewer as-built plans and profiles. This was a real challenge, since the city does not have a staff member who works on maintaining sewer plans full time. Mendez cobbled together sewer plans from various files including street plans, tract plans, and parks and recreation records. One thing Mendez had working for him was the city's mature GIS program, replete with many datasets

developed over a span of more than 10 years. This information ensured greater accuracy and provided aerial photography for cross-referencing.

A project goal was to hyperlink sewer plans to the GIS-based sewer line data so that the information would be accessible via the Online Sewer Access System Web application. The database was created using ArcGIS for Desktop from Esri. To improve the Web application's functionality, the city recently launched Esri's ArcGIS for Server. The site provides information to engineers and contractors who must determine where to connect private sewer pipes to the public sewer main. Public works field crews use the site to research and obtain plans. When a user visits the city Web site, the Web application displays the sewer map. With a click on a sewer line, the user can retrieve a scanned PDF of the as-built plan.

"GIS made everything come together," Mendez said. "Culver City staff can go into the Web application and access everything they need from one system. GIS is saving us a lot of time because we don't have to dig through cabinets for information or rely on memory."

Since Culver City was founded almost a century ago, some of the original sewer plans went missing. Other plans, dating back to 1922, were very difficult to scan internally, so the city completed that portion of the project using contracted experts. However, there were still blanks to be filled.



The new Sewer Web Application offers more map space, has a cleaner look, and is more user friendly than the previous web application.

"We used numbers in each field of the attribute table within the GIS data to designate the status of sewer plans," Mendez said. "For example, I would place a 0 in the attribute information if the sewer line was not in need of attention. A 1 means it is missing a sewer plan. A 2 means the plans could not be scanned and needed to be contracted out. A 3 indicated there was a question for the sewer maintenance manager."

Mendez coordinated as-built plans with sewer lines where possible. If he could not find a match, he used aerial images or GPS data to georeference the location. Culver City engineers checked every single line and point to ensure accuracy before approving the data.

## A Job Well Done

Culver City now has an up-to-date printed Citywide Sewer GIS Map Book and the [Online Sewer Access System](#) to share the data with the public. When repairs are needed, the public can now access sewer information online and determine the location of a private sewer connection to the public sewer. This eliminates the need for people to travel to city hall and research the information, thereby saving time for the city staff and members of the public.

"Our sewer GIS database has also increased productivity for engineering and operations and propagated better information flow a thousand-fold," said Johnnie Griffing, GIS project manager. "Thematic maps are now generated that depict entire portions of the system as connected to each pump station. This was a big revelation for engineers and field crews who had not previously had a means for visualizing the extent of the sewer system's relationship to pump stations. The map book offers a fine level of detail previously only available by retrieving and viewing hundreds of paper drawings—reflecting the most current and staff-verified picture of sewer distribution as it is in the field.

Management can now review these details of the system to make better decisions."

The Online Sewer Access System map shows sewer pipes, flow direction, manholes, aerial imagery, parcels, pump stations, pumps, and wet wells. Sewer data is served on top of city infrastructure layers such as streets and city boundaries, all within the GIS. Users can navigate based on address or intersection, click on a line or point, see the attribute information, and view associated scanned drawings that have been hyperlinked.

The city's sewer data now includes construction material, footage, year installed, tributary, and ownership data. Material, size, and diameter of all pipes have been documented as well as digitized outfalls—large-diameter sewer pipes that take Culver City sewer flows to the sewer treatment plant. There is also manhole data including small access points, called cleanouts, that reside on private property and larger sewer maintenance access points, called lamp holes, that are located in alleys. Such geographic points were not included in previous versions of sewer maps. Mendez is currently adding manhole identification numbers that correlate with map book pages to further assist field crews.

"We use the map book now rather than the large roll-up map," said Mate Gaspar, engineering services manager for Culver City. "The map book is easy to read, and I know it is complete, updated, and accurate. We have also increased efficiency by

using the Online Sewer Access System to view sewer plans rather than pull maps from the plan room."

(This article originally appeared in the July 2010 issue of *ArcWatch*.)

# Planning and Analysis

Public works managers need to balance infrastructure investment against an asset's expected life-span. GIS provides an important capability in this analysis because it facilitates the comparison of repair or replacement scenarios using different geodatasets to support the decision-making process.

# Town Sharpens Proactive Sewer System Management

Alan Saine, Civil Engineer, Town of Mooresville, North Carolina

In 2010, the Town of Mooresville, North Carolina, began experiencing a rise in the number of sanitary overflows and sewer stoppages. The reason for the problem was evident: the Town of Mooresville has more than 6,000 manholes and 250 miles of sanitary sewer gravity-main lines, and only 30 percent of that infrastructure has been constructed in the last 20 years. In addition to aging infrastructure, the Town of Mooresville population has tripled in the last 20 years, thus putting more strain on the significantly aged sanitary sewer system.



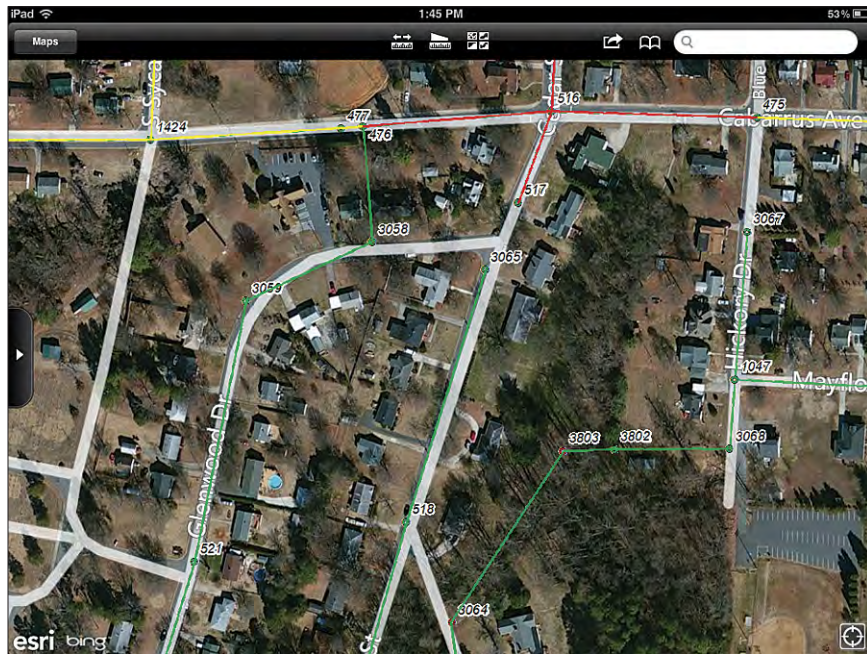
A sewer overflow.

Mooresville, like most municipalities, has permit requirements—in this case regulated by the Division of Water Quality, a division of the North Carolina Department of Environment and Natural Resources. One of the requirements is that the permittee shall assess all cleaning needs and develop and implement a program appropriately cleaning all sewer lines. The Mooresville Water/Sewer Maintenance Department (WSMD) manages this requirement on a day-to-day basis and recently requested the assistance of the Engineering Department to help determine all the distressed spots, or hot spots, to more strategically and effectively clean and maintain the system.

"Economic growth kept our staff very busy for years with installing all the water and sewer taps," says Jamie Johnson, water/sewer maintenance field supervisor. "Since the growth slowed due to the recession, we had to move from a reactive approach to being proactive. In the past, crews would alternate cleaning sewer lines in whatever area they wanted to, and areas were being left out. By restructuring crews, we dedicated a crew to do all the line cleaning, and with this continuity, we were able to grasp the needs of our wastewater collection system."



To assist WSMD in identifying distressed spots on the system, the Engineering Department needed to pinpoint these locations on a map and assign dates for when the sewer features (manholes, sewer main) were cleaned. WSMD maintained monthly data, from August 2009 to January 2011, in Microsoft Excel spreadsheets of where and when the sewer cleaning occurred. Each spreadsheet contained the cleaning data for that month, as well as a unique identifier, Manhole ID (MHID), to capture the location. Fortunately, the Engineering Department had recently finished a yearlong



The Esri application on the iOS device displays the sewer cleaning data and the Manhole IDs (MHIDs); therefore, the user knows if that line has been cleaned recently.

project, which employed ArcGIS software, to locate, map, and input all the features of the town's sanitary sewer system. Once the spreadsheets were reviewed, Python scripting was chosen as an optimal way to process the batch of Excel format cleaning data and generate a comprehensive dataset.

## Automating with Python

Creating the cleaning data would require the repetition of several steps; this process was simplified using Python. The Python script was developed so that users would have the Excel file in a folder on a computer, and they can extract the month and MHIDs from it and perform several analyses. The Python script was made accessible to any user via ArcGIS.

The first step was to create the cleaning data. ArcGIS was used to calculate the number of sewer mains that were cleaned that month and their lengths. The frequency of how often a line had been cleaned was calculated and coded using a red/yellow/green scheme. Hot spots, or areas that had been cleaned seven or more times, were displayed as red so it would be evident where there were issues.

## Locating the Cleaning Hot Spots

The ability to map where the sewer cleaning was occurring and how often it occurred yielded some interesting results. There were over a dozen separate areas where the sewer mains



had been cleaned 7 to 12 times in an 18-month span. This information became a catalyst for improved interdepartmental communication between WSMD and the Town of Mooresville Fat Oils Grease (FOG) Department.

Says Jamie Levis, FOG compliance officer, "Our sewer cleaning map has helped us identify those areas that require more frequent inspections and increased pumping/cleaning frequencies for food service establishments. The use of GIS has helped the FOG staff identify and remedy problem grease interceptors [problem spots] on multiple occasions. With the use of this tool, what used to take weeks now takes minutes to look up and identify."

## Fixing the Hot Spots

Mapping the hot spots gave WSMD and the FOG Department specific areas to target and improve. Several methods were used to investigate these areas, such as reviewing closed-circuit television of the sewer mains and inspecting all the oil/water separators in the vicinity of the sewer cleaning hot spot. Several problems were fixed by using simple root control treatments and locating grease violations by local restaurants.

Prior to this project being implemented, in 2010, WSMD did not know where the hot spots were and did not have a way to track areas that were being repeatedly cleaned. In 2010, the town cleaned 51 miles of sewer mains. Of those cleaned sewer mains,

58 percent had already been cleaned earlier that year. In 2011, after the project, the town cleaned 144 miles of sewer mains, and only 32 percent were repeats. By having the ability to identify hot spots and correct issues, the town was able to clean almost three times as many areas and cut the repeat trips by 26 percent.

"Since our productivity has increased, we have noticed a decrease in main line stoppages and after-hours callbacks, resulting in cost reductions, including less overtime pay for employees," says Johnson.

Ryan Rase, deputy town manager, also praises the results of the project: "The WSMD has not been immune to the downturn in the economy, and we are constantly being asked to do more with less. Through the use of technology and teamwork, we were able to provide a tangible example of how WSMD has been able to become more efficient."

## Going Mobile

Today, the town continues to map the sewer cleaning. Using Esri's ArcGIS, workers can now use iPads to log cleaning data directly into the system from the field (instead of keeping track of Excel spreadsheets). The sewer cleaning crew can instantly view where the cleaning truck has been in the past two years and be strategic in cleaning by maximizing the route of the cleaning crew and migrating to areas that need attention. Additionally, it can easily identify hot spots that show up red on the map and communicate

where customer intervention may be needed. This project created a proactive approach to maintaining the town sewer system and enhanced interdepartmental communication.

## About the Author

Alan Saine is a civil engineer and engineering intern at the Town of Mooresville in North Carolina. He is a graduate of the University of North Carolina, Charlotte, and is currently pursuing his master's degree in geospatial information science and technology at North Carolina State University. At Mooresville, he recently finished implementing an enterprise GIS system in the Public Services Division. He is a member of URISA, is currently working toward his GISP, and plans to sit for the Professional Engineering Exam in 2013.

## Related Podcast

### [ArcGIS for Local Government Simplifies Government Workflows](#)

Scott Oppman, local government solutions project manager at Esri, gives a technical overview of Esri's solution for simplifying GIS workflows in local governments.

[Listen to the podcast.](#) [07:00 | 7 MB]

(This article originally appeared in the Fall 2012 issue of ArcNews.)

# Lidar, Building Information Modeling, and GIS Converge

## Bringing Business Efficiencies to Milwaukee Metropolitan Sewerage District

Karen Richardson, Esri

Milwaukee, Wisconsin, is the 26th largest city in the United States; its regional wastewater system is among the largest, most sophisticated, and well run in the country. The Milwaukee Metropolitan Sewerage District (MMSD) provides wastewater services for 28 municipalities comprising about one million people. The district's 411-square-mile planning area includes all cities and villages except the City of South Milwaukee. Serving these municipalities requires MMSD to develop spatial inventories and applications that meet internal and external needs for planning and design. Like any large facility, many of these efforts began organically within single departments to answer a specific need for one project.

To ease the consolidation of facilities data information, MMSD called on HNTB of Kansas City, Missouri, a national infrastructure firm and Esri Silver Partner, to conduct a practical research project that pilots a data management approach for [lidar](#) and [building information modeling](#) (BIM) data. The project specifically studied the practical business applications integrating 3D design and construction data from an aeration system rehabilitation project into MMSD's enterprise GIS environment.

### Put the Money Where the Return on Investment Is

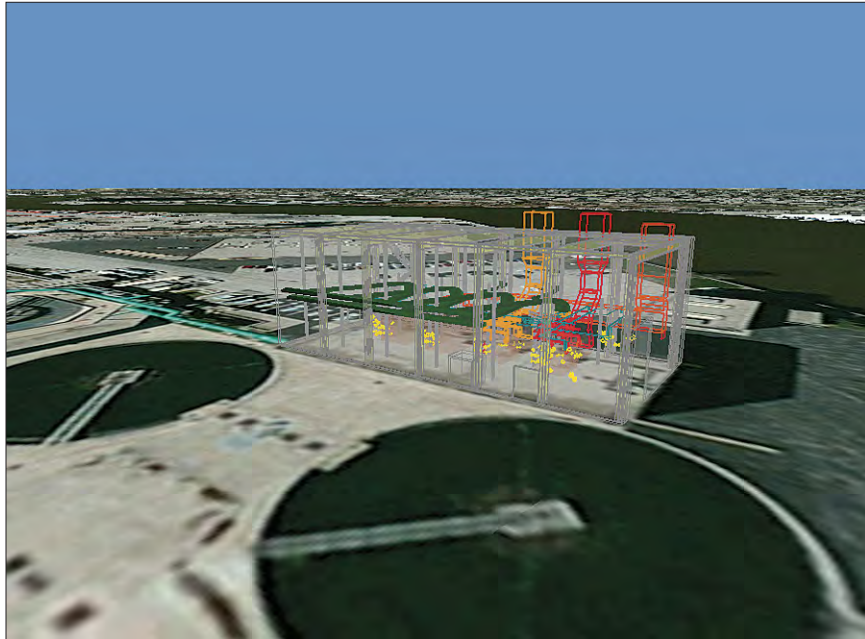
As part of this research and development project, return-on-investment estimates were generated for distinct use cases, focusing on integrating lidar and BIM technology with GIS to greatly improve access and retrieval of as-built conditions for MMSD employees and their consultants. A number of different application development platforms and existing software solutions were considered for the project. Each software package was evaluated based on criteria defined by MMSD. ArcGIS Engine was selected as the platform that met all these requirements. [ArcGIS Engine](#) is a collection of GIS components and developer resources that can be embedded into other applications, allowing dynamic mapping and GIS capabilities in many different environments.

### An Expandable Enterprise System

MMSD was already a user of Esri technology, having adopted [ArcGIS for Desktop](#) software in 2003 for department-specific solutions. In 2009, MMSD consulted with HNTB to help facilitate the move into an enterprise environment using [ArcGIS for Server](#). This was a multiphase implementation that included the

development of a business data model. The data model focused on existing data inventory and application user needs at the time, including improving mapping and organizational efficiencies, as well as bringing added value to MMSD business operations.

In 2011, MMSD completed the project, developing several applications that addressed specific areas to map related data to the district's infrastructure resources and to service areas.



Interactive viewing of the 3D geodatabase in the ArcGIS Engine application, including dynamic symbolization of features.

"Historically, information regarding water quality, water quality improvements, and physical features of water were located in separate departments at MMSD," says Jeff Siegel, GISP, associate vice president and technology solutions center director, HNTB. "Consolidation of this information took time, money, and executive sponsorship to change priorities. Now, all staff can access and output this information from their desktops without the help or sponsorship of other staff. The staff has the information it needs to make better and faster decisions, which was another of our guiding objectives."

For this pilot project, among the many criteria MMSD had, data and document access was again selected as a high priority. "In this scenario, a 3D model was created and integrated into GIS," says Siegel.

Again, the objective was for users to view and select features on their own. In this case, the 3D model would be displayed within an environment they are familiar with—the ArcGIS environment. Using this model, staff can access related data in external databases, including documents relevant to the 3D model feature the user selected.

## Modern Technology Studies a Historic Facility

The study area included Jones Island Water Reclamation Facility, one of two wastewater treatment facilities within the district's service area. Jones Island is located on the shores of Lake Michigan in Milwaukee. On average, the Jones Island facility collects and treats a maximum daily flow of 300 million gallons of wastewater, returning clean, clear water to Lake Michigan.

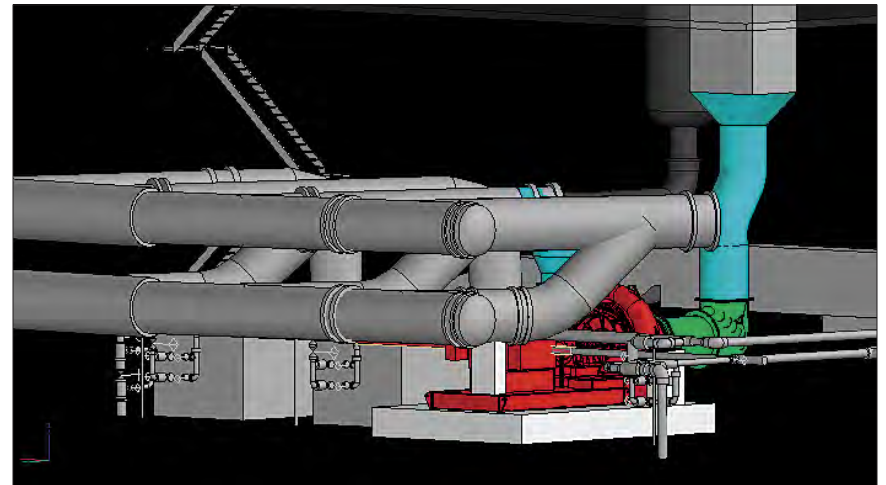
As part of the Milwaukee Metropolitan Sewerage District 2020 Facilities Plan, HNTB was tasked with developing design improvements for the Jones Island Water Reclamation Facility aeration system. The project will lead to a reduction of electrical energy usage through gains in aeration system blower and diffuser efficiencies, as well as enhancements to controlling air distribution to aeration basins and channels.

To gather accurate and precise as-built conditions of the aeration system, HNTB engineers decided to collect internal facility data to derive a BIM from static lidar point clouds. This approach quickly brought dependable and accurate existing conditions information to the designers in an interactive 3D design environment.

"Because static lidar scanning is a direct line-of-sight method of data collection, the entire interior of a facility required enough scans for every single feature to be captured," says Siegel. "The estimated number of scans required increases based on the number of floors and the complexity of the building."

A typical static lidar scan takes about 10 to 15 minutes. So a crew of two has the ability to scan anywhere from four to six locations—typically a room or hallway—in just one hour. For this project, more than 100 scans were collected in one day to gather point clouds of the entire facility.

The decision to use BIM to manage the design process allowed many different disciplines to collaborate at different phases of the facility design project. BIM is defined as a process using a combination of technologies and resources to capture, manage, analyze, and display a digital representation of physical and functional characteristics of a facility.



The application employs dynamic linkages from the geodatabase to the building information model (BIM) for viewing greater 3D design detail.

## Realistic 3D Models for Everyday Use

Integrating lidar and BIM data with MMSD's enterprise GIS was thought to offer many benefits to the agency. "In our opinion, this was the most well-organized way to package up and deliver all our 3D design and construction methods to our client," says Siegel.

By extending BIM and lidar into the ArcGIS environment, the district can benefit from the data and integration points between the technologies, realizing significant operational efficiencies. Asset and facilities management is one area where improvements to maintenance management and document management systems can happen. The ability to manage data and keep a record of work orders and maintenance activity is invaluable to managers.

Another area where the district is expected to realize efficiencies is in plant and facilities operations. "There are a number of ways a 3D, geographically based representation of the facilities will help our customer," says Siegel. "From safety and training to creating documentation and just having an operational database, GIS makes it easy to manage and use the collected information and model the facility dynamically in so many ways."

Facility planning is another area where this approach can offer some real payback. From modeling proposed upgrades to capital improvements, the ease of sharing this information in an easily understandable format is a big win. "Since this is a historical

landmark for the area, there are many complexities in maintaining the 3D model to the data management standards that MMSD expects," says Siegel. "Viewing a 3D model that is intelligent—meaning we can see more information about the facility picture we are displaying—makes it so much more efficient to answer questions, propose new scenarios, and move the projects along at a quicker pace."

## Lessons Learned

The most critical factor preventing more robust integration between BIM and GIS is the native incompatibility of the two data formats. A critical data integration fracture between BIM and GIS is the importance of defining spatial coordinates of the BIM file at the beginning of the project. "The purpose of this is to allow us and our client to accurately locate a building within a site and to give it a physical location context at larger scales that can be overlaid with aerial imagery and topographic and other layers from an enterprise geodatabase," says Siegel.

For information on using GIS for facilities, visit [esri.com/facilities](https://esri.com/facilities).

(This article originally appeared in the Spring 2013 issue of ArcNews.)

# Field Mobility

Mobile GIS gives public works field staff tools for remotely collecting and confirming information about asset locations and conditions. From the office, data can be sent to the field for validation and then returned to the operation's centralized geodatabase for distribution in near real time, providing timely and accurate information throughout the enterprise.



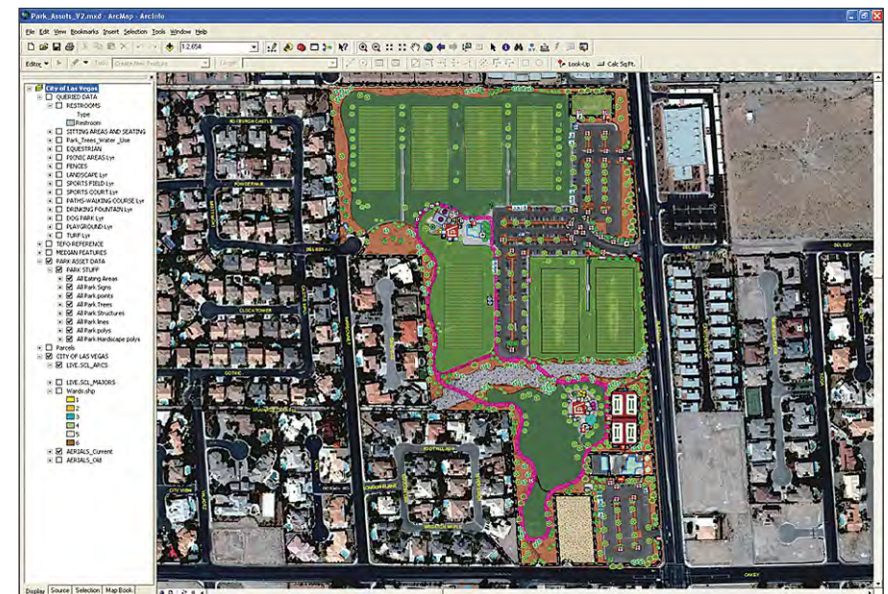
# City of Las Vegas Implements ParkPAD for Mobile Asset Management

# Jim Baumann, Esri

Founded more than 100 years ago, Las Vegas, Nevada, began as a stopover on the pioneer trails heading west. Soon it evolved into a popular railroad town and staging point for the many mining operations in the area. In 1911, the population was about 800 people. Las Vegas then began to grow in leaps and bounds, with construction of nearby Hoover Dam during the 1930s and the beginning of its now massive casino industry during the 1940s and 1950s. Today, the Greater Las Vegas metropolitan area is home to nearly two million residents.

Maintaining the infrastructure necessary to support a population of this size requires carefully coordinated efforts by the city's Department of Operations and Maintenance to minimize redundant work and make the most of shrinking city coffers during difficult economic times. While the department has used ArcGIS software for many years, a different vendor's maintenance management system (MMS) had been implemented to collect and manage the assets within its parks and related facilities. Because the drawbacks of that particular system were substantial, in 2009, the Department of Operations and Maintenance began the development and deployment of its Park Asset Data Collection and Data Conversion Program (ParkPAD) to replace the legacy MMS. Based on [ArcPad](#) software, ParkPAD has greatly

improved the department's capability to collect and manage park assets because it is fully compatible with the department's existing ArcGIS enterprise system. Field crews can now view a digitized image of a park or other venue and immediately determine whether the data has already been collected. Getting



All American Park showing the base layers and assets added over the aerial image, which helps those using the map understand what they are looking at.



data in and out of the new system is a quick and easy process, and updates can be performed in near real time.

The Parks and Open Spaces Division is currently working with the Information Technologies Department to complete the digitization of the base layers for all the city's parks, landscaped areas, trails, medians, school landscaping, and sports fields. This new parks inventory database has produced some immediate cost benefits to the city. Since Las Vegas is in the Mojave Desert, water conservation is very important. The vegetation layers in the database are used to determine the square footage of each park so that the necessary amounts of seed, fertilizers, and herbicides can be accurately calculated and purchased. In a related project, the data from an earlier tree study was added to the database so that the parks maintenance staff could determine water usage requirements for each tree based on species, size, location, and so on.

In the next stage of the project, an irrigation layer will be created for the database and will include the locations of irrigation clocks, stations, valves, and controls. This will allow the irrigation system repair crews to quickly locate equipment when there is a break in the water main or if a valve becomes inoperable. In addition, these new base layers will make it easier to collect and track the number, location, and condition of assets, such as playgrounds, shade structures, drinking fountains, picnic areas, and benches.

This new data will be included in the city's enterprise GIS so that it is available to the other departments that rely on it. Currently, these departments maintain their own datasets for park assets, and there are discrepancies between them. Using the same dataset is particularly useful for the Department of Operations and Maintenance, which maintains the parks, and the Department of Parks, Recreation and Neighborhood Services, which schedules outdoor events, maintains sports fields, and manages the use of picnic and other recreation areas.

"Our use of GIS continues to grow," says Joel Hillhouse, GIS analyst at the City of Las Vegas. "In the near future, we will be posting our parks data on the city website for residents and visitors so that they can find information and make reservations for a specific site using an interactive park finder."

(This article originally appeared in the Spring 2012 issue of *ArcNews*.)

# Seeing the Signs

## The City of Glendale Partners with 3M to Manage Street Signs More Effectively

Karen Richardson, Esri

Got signs? The City of Glendale, in Los Angeles County, California, does. In fact, it had 2,000 more street signs than it thought it did. While this surprise may not seem to be a big deal to some, for Glendale City staff, not having an accurate count of their street signs could mean the difference between staying in budget and exceeding it by thousands of dollars.

"Each street sign costs at least \$200," says David Lew, parking and traffic supervisor, City of Glendale. "If we need to replace them

and end up miscounting by a couple thousand signs, we could be in a pretty big financial hole."

Glendale city staff manually inventoried their street signs for decades by driving the city streets and recording where signs—including street name and road safety signs—were located. While this system seemed to work well, the introduction of new minimum reflectivity standards, as well as a timetable for city agencies to comply with these new regulations by the Federal Department of Transportation, pushed the city to adopt a more comprehensive solution for road sign management. Glendale staff needed to get a better handle on what their street sign inventory was for replacement and maintenance purposes. The city found itself helping beta test and implement a 3M sign management system that uses ArcGIS to help organize and display sign information more easily for office and field-workers.

### When Every Sign Matters

Headquartered in St. Paul, Minnesota, 3M is a \$30 billion company creating unique products that make people's lives easier. The company prides itself on its innovation and takes the business of inventing seriously. Finding a solution for inventorying



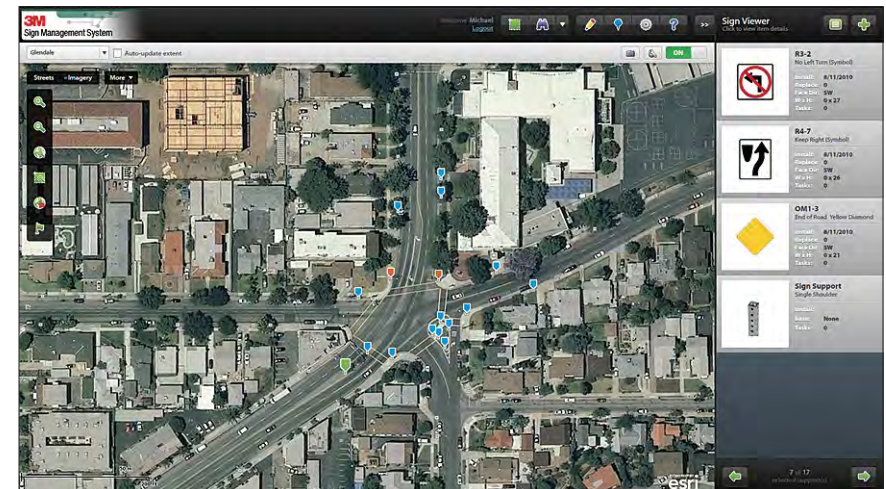
street signs was tackled with the same visionary thinking that has made the company so successful.

The 3M sign management system is used by the sign and traffic department at the City of Glendale, where a staff of nine uses the system for maintenance to accurately budget for and plan sign replacement in the city. 3M coordinated inventory of all the street signs for Glendale, including data capture and asset assessment, and put it into the software solution. City staff were then trained on the management tools they would be using to update and keep the inventory current.

"We really had no idea how many signs we had," says Lew. "We found out that our estimate was only off by 2,000 signs, out of 28,000 that the city maintains, which is pretty good. But when you are talking about being required to replace signs every 5 to 10 years and having accurate data in case of accidents or lawsuits related to signage, every sign is important."

3M has performed hundreds of traffic engineering studies and uses this knowledge to build in predictive modeling for sign management that assesses the sign type, installation data, and other attributes to estimate when the next replacement date for each sign may be. This intelligence makes it easier for Lew's staff to manage the sign inventory. They can query the signs to find those that are deemed critical for maintenance or signs that possibly fall below the federal minimum requirements.

After the signs are found, a work order can be placed in the system and downloaded on a mobile device by a crew member out in the field. The mobile devices used contain GPS receivers, so as a field-worker approaches the sign, he or she can select the sign that appears on the screen, ensure that it is the correct sign that needs to be replaced, pull up and fill out the work order, and then sync the work order back up into the system. "This system works especially well in an emergency situation, such as replacing a sign that has been knocked down," says Lew. "Within a couple of hours, the sign can be fixed and the work order processed."



Having a system that manages street signs is helping Glendale maintain assets more efficiently, keep constituents safe, and protect the city against lawsuits and noncompliance.



## A Total Solution for Street Sign Management

One of the nice aspects of the system is the fact that the web interface that is used back in the office is the same interface that is seen on the mobile devices. The interface is very graphic in nature, since it uses ArcGIS web map services. These services provide an interactive map for workers to pan and zoom so they understand exactly where the signs are located in the city. This has made training the staff very easy, especially important in California city agencies, where fiscal troubles have meant moving staff to different departments or reducing the work force. "Once the staff is trained on one system or the other, it's a done deal—we don't have to retrain them," says Lew. "This is a huge time- and money saver for the city."

## To Serve and Protect

Having a system that manages street signs is helping Glendale more efficiently manage assets, keep constituents safe, and protect the city against lawsuits and noncompliance. As the city continues to grow and more streets are added to accommodate this growth, there is a system in place to maintain those new signs. And no longer will agency workers put up a new sign at an intersection and forget about it. All these signs will be appropriately tracked in a manageable way.

"Signs have a definite life to them," says Lew. "After a few years, they lose their reflectivity. We as a city have to take care of this problem so motorists can see the signs, especially at night."



## The Cloud Option

Glendale is maintaining its system at the city, but other cities have the option of a cloud-based system where 3M can host it on its own servers. "This is a nice option for smaller municipalities that may not have the budget of larger cities but still have the responsibility to maintain their street and road safety signs," says Debra Gaborik-Snyder, business development and project manager for 3M's traffic safety systems division.

A cloud solution meant that 3M needed to find a level of service that had little or no interruption and systems that could all talk to each other in a common language. At first, 3M staff looked at open source GIS technology but, working with Esri Partner GIS, Inc., based in Birmingham, Alabama, chose ArcGIS instead.

Says Gaborik-Snyder, "Choosing one platform that is proven and has the kinks worked out will save us and our clients time and money in the end."

(This article originally appeared in the Spring 2013 issue of *ArcNews*.)

# Operational Awareness

Because GIS can integrate and analyze data from different monitoring and management systems, including enterprise asset management (EAM), supervisory control and data acquisition (SCADA), and location-based scheduling, the public works director is provided with an immediate view of the entire public works operation.

# Qatar Implements Geocentric Budgetary System to Simplify Project Approval Process

Jim Baumann, Esri

GIS technology from Esri is being used to track infrastructure project locations in the State of Qatar, a Middle East nation on the Persian Gulf.

Qatar implemented a nationwide geographic information system based on Esri's ArcGIS more than 15 years ago. Since that time, it has continued to expand its use of geospatial technology.

The country's public works authority recently implemented Moazanah, an infrastructure management system that uses ArcGIS technology to track project locations, which reduces construction costs and disruption to local businesses and residents.

The screenshot displays the 'Estimate form' in the Moazanah system. It includes fields for 'Proposed Project Name in English' and 'Proposed Project Name in Arabic', both containing 'Design Project for Hamad Medical City and EHT hospital'. Other fields include 'Planned Start Date' (01/12/2010), 'Duration' (30), 'Planned Value' (2,000,000.00), and 'Actual Value'. There are also sections for 'Prepare Project Brief', 'Prepare Tender Documents', 'Tender Invitation', 'Technical Evaluation', 'Financial Evaluation', 'Tender Award', 'Commencement Date', and 'Completion Date'. The form is divided into tabs for 'Estimate', 'Details', and 'Location'.

The project management view shows a high-level project estimate for a medical facility.

The screenshot displays the 'Projects List' in the Moazanah system. It shows a table of projects with columns for Agency Name, Project Name in English, Budget Code, Provision, Type, Year, Cost (QAR), Percent Complete, Project Status, OnHold Status, Project Manager, Project Coordinator, and Last updated. The table lists several projects, including 'Supervision project for new school in West Bay area' and 'Construction project for new school in West Bay area'. The table is filtered by 'Progress Status: Not Started'.

| Agency Name                                | Project Name in English  | Budget Code | Provision | Type       | Year    | Cost (QAR)   | Percent Complete | Project Status          | OnHold Status | Project Manager | Project Coordinator | Last updated |
|--|--|-------------|-----------|------------|---------|--------------|------------------|-------------------------|---------------|-----------------|---------------------|--------------|
| Ministry of Urban Planning and Development | Supervision project for new school in West Bay area                            | BUDG10      | 11        | Ascending  | 2010-11 | 800,000.00   | 0                | Approved, Conditionally |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Construction project for new school in West Bay area                           | BUDG10      | 11        | Descending | 2010-11 | 2,000,000.00 | 0                | Approved, Conditionally |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Construction project for new school for American Embassy                       | BUDG10      | 11        | Descending | 2010-11 | 2,000,000.00 | 0                | Approved                |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Supervision project for new office for the councilor                           | BUDG10      | 11        | Descending | 2010-11 | 900,000.00   | 0                | Approved                |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Construction project for new office for the councilor                          | BUDG10      | 11        | Descending | 2010-11 | 2,000,000.00 | 0                | Approved                |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Design project for extension of library near the upcoming Islamic Museum       | BUDG10      | P45-12    | D          | 2010-11 | 750,000.00   | 0                | Budget Approved         |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Design project for new school in West Bay area                                 | BUDG10      | P45-12    | D          | 2010-11 | 500,000.00   | 0                | Budget Approved         |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Design project of new office for the councilor                                 | BUDG10      | P45-12    | D          | 2010-11 | 40,000.00    | 0                | Budget Approved         |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Construction project for new museum for show casing ancient Islamic Art        | BUDG10      | 11        | Descending | 2010-11 | 5,000,000.00 | 0                | Approved, Conditionally |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Construction project for extension of library near the upcoming Islamic Museum | BUDG10      | 11        | Descending | 2010-11 | 900,000.00   | 0                | Rejected                |               | Mohsen Said     |                     | 10/10/2010   |
| Ministry of Urban Planning and Development | Supervision project for extension of library near the upcoming Islamic Museum  | BUDG10      | 11        | Descending | 2010-11 | 700,000.00   | 0                | Rejected                |               | Mohsen Said     |                     | 10/10/2010   |

This map view displays a list of all projects so they can be reviewed by the project coordinator.



"Moazanah manages our government infrastructure projects from beginning to end," said Nasser Ali Al Mawlawi, an engineer and the president of Ashghal, the Qatar public works authority. "It has not only expedited the review and approval process, but we [also] are already seeing a cost savings, which will undoubtedly result in a significant return on investment."

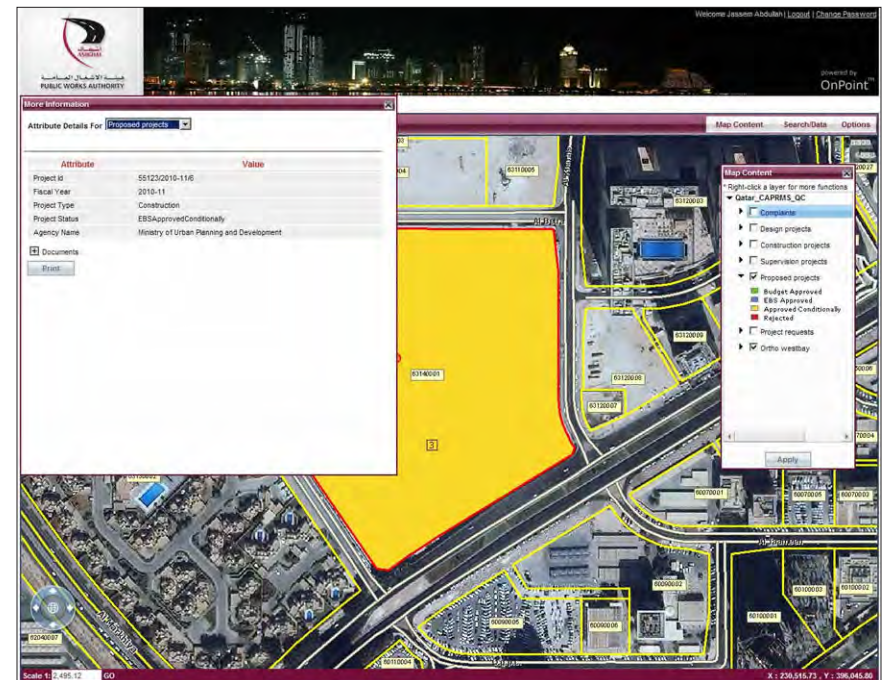
## Boom in Population and Infrastructure

With its wealth in oil and natural gas reserves, resulting in an expansion of trade and investment, Qatar's population has more than tripled to 1.7 million since the 1990s. This population growth has sparked an unprecedented boom in construction and infrastructure development projects.

Ashghal is responsible for a significant amount of the country's infrastructure, including roads, wastewater systems, and public buildings. But many other government organizations also are in charge of designing, building, and maintaining government facilities. Because all government infrastructure projects compete for public funding, Ashghal was assigned to implement a system to coordinate the annual capital project budget application process.

## Traditional Budget Process Led to Errors and Delays

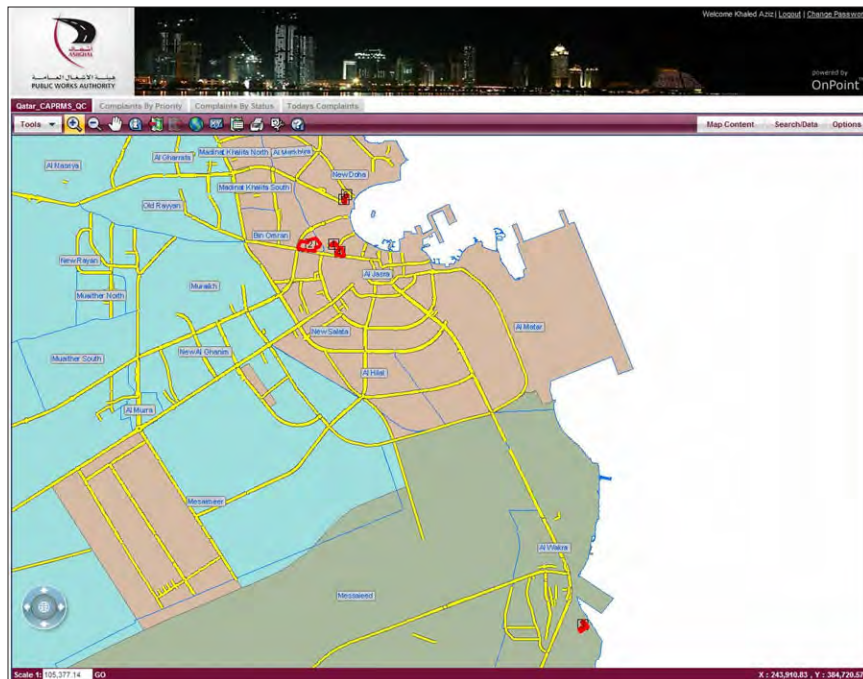
Historically, the budget application process for major infrastructure projects was primarily paper based. This often led to paperwork being incomplete and lost, resulting in protracted meetings between the ministries and Ashghal to resolve conflicts and miscommunications, as well as late project submissions and frequent submission deadline extensions. That led to limited opportunities to collaborate on projects and complicated the tracking process.



This map view shows proposed projects with attribute details.



To automate this antiquated process, Ashghal's Engineering Business Services Department defined the requirements for a capital project request management system, Moazanah (Arabic for "budget"), to facilitate the country's budgetary review and approval process. Moazanah's overarching aim is to make sure that all capital project funding applications move forward smoothly and with greater clarity for the agencies and individuals involved in the review process. The Moazanah project was ultimately awarded to Rolta Middle East, an Esri partner.



This is a high-level map view of multiple projects being proposed.

## GIS-Based System Resolves Budget Process Bottlenecks

On the surface, a capital budget review process—with its mix of estimates and textual details covering legalities, materials, construction services, and logistics—may seem to lack geographic content.

Georeferencing, however, is central to Moazanah. Each project has a geographic extent, drawing attention to any overlapping neighboring project. Each overlap becomes an opportunity for coordination and cost savings.

For example, it is obviously costly and inefficient to repeat construction work on a stretch of roadway. However, in the past, projects were proposed, funded, and completed without consideration for other projects that involved tearing up the same stretch of road that had just been resurfaced. These repeated disruptions cost the government money and unnecessarily impacted local businesses and impeded traffic flow throughout the affected area.

Using Esri's ArcGIS technology—a key component within Moazanah—to track project locations helps coordinate neighboring or associated work, which reduces construction costs and disruption to local businesses and residents.

Central to the Moazanah solution is Rolta's OnPoint, a web-based GIS application; SharePoint Web Parts; and Microsoft SQL Server.

Esri's [ArcGIS for Server](#) manages the spatial data for subsequent analysis and distribution. Moazanah is also integrated with Primavera's Project Portfolio Management (PPM) to organize and manage the proposed projects once the budget is approved.

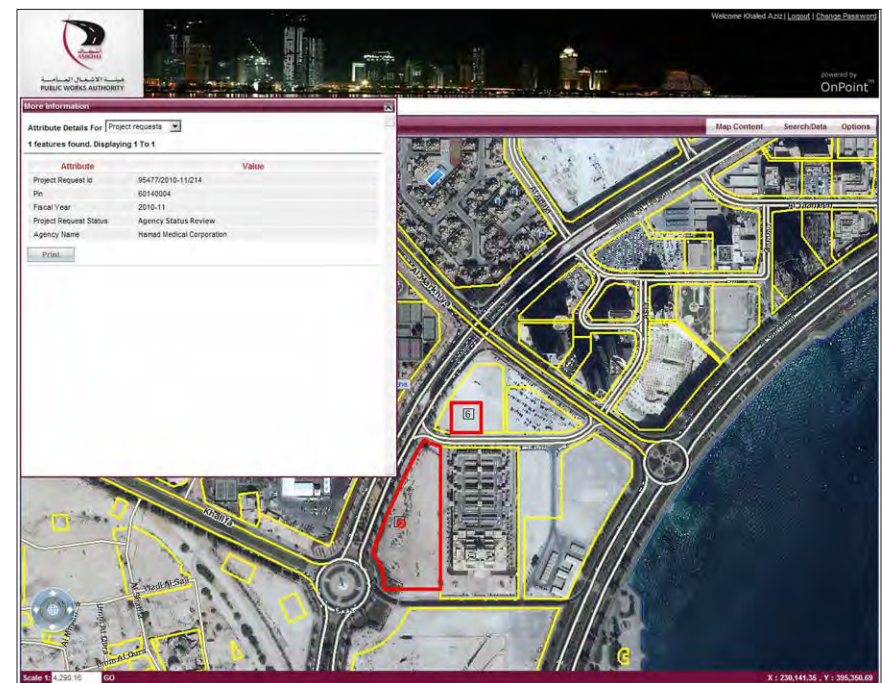
## System Is Simple to Use

The system features a series of interconnected SharePoint forms that are specific to the role of the individual who logs in. Because ease of use was of utmost importance to Moazanah's successful deployment, the user interface was deliberately kept clean and intuitive.

"We recognized early on that Ashghal had very ambitious plans for this system," said Shafik Jiwani, executive vice president of global business development at Rolta. "With over 23 agencies involved in the process, hundreds of users, and hundreds of projects filled with numerous details, it was quite a challenge to present it all in a way that felt intuitive to the user. As tempting as it was to build a sophisticated interface with lots of complex tools, the smart approach was to keep the interface clean and simple. It had to be easy to find needed information to make informed assessments and immediate decisions."

Key performance indicators (KPI) are extracted from the data and displayed on a dashboard customized for a department head's interests and responsibilities. Moazanah is used throughout the project assessment process to evaluate a proposed project's

suitability and impact on its specified location. During this process, various location-based government regulations, such as zoning, must be considered. GIS is also used to drive other geospatially based analyses, such as the number of project requests submitted within a particular municipality and the status of projects.



These attribute details and map view show an agency's proposed project that is spread over two parcels.

## **New System Increases Efficiency and Facilitates Collaboration**

Moazanah has made Qatar's budgetary process more efficient by allowing required information to be submitted and examined digitally. All stakeholders can evaluate and discuss the same information as it proceeds through the review procedures, facilitating collaboration and coordination. Qatar now has an immediate status report for all proposed projects in the country.

"Moazanah provides us with a forum to discuss and analyze the country's infrastructure project proposals so that we can confidently move forward with them, knowing they are properly managed and within budget," said Abdussamad Mohamed Al Makei, Ashghal's manager of the Engineering Business Services Department.

(This article originally appeared in the May 2012 issue of *ArcWatch*.)

## Jim Baumann, Esri

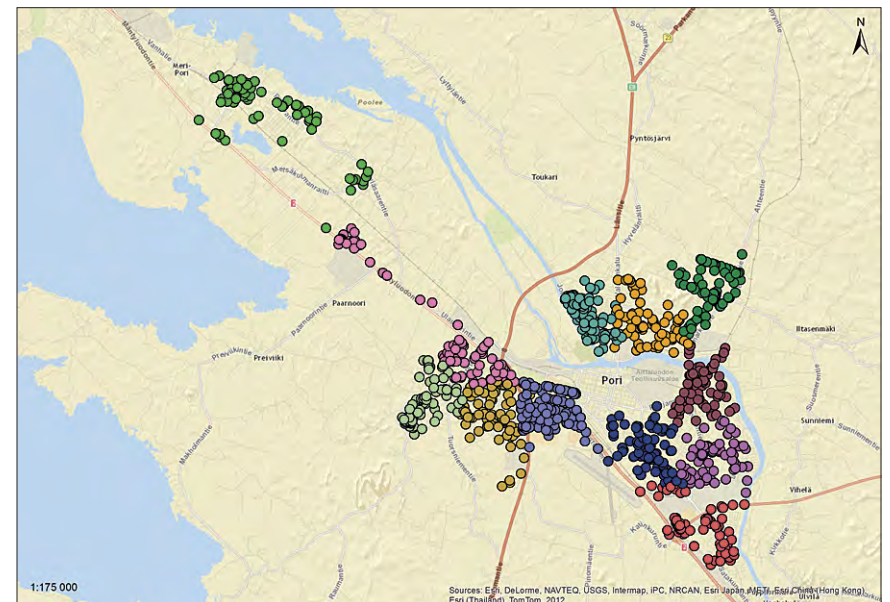
John III, Duke of Finland and son of King Gustav I of Sweden, founded Pori in the Grand Duchy of Finland in 1558. Located at the mouth of the Kokemäenjoki River, the settlement was to serve as a harbor and market town to revitalize trade with continental Europe. Pori was originally populated with approximately 300 residents who relocated from the nearby town of Ulvila. The new city quickly became commercially successful, and Pori prospered as a regional center for commerce and shipbuilding.

Today, Pori has nearly 84,000 residents who enjoy a high standard of living. The city is home to three universities, and the Pori Jazz Festival is one of the best-known music festivals in Europe.

Because of Pori's location in northern Europe, snow cover in the city lasts more than one-third of the year. Snowstorms can start as early as October and last into late April. During this time, city workers must keep 1,163 kilometers (723 miles) of streets and 295 kilometers (184 miles) of bicycle paths free of snow and ice.

Pori's public works department is a longtime user of GIS software, primarily for asset management and infrastructure maintenance projects. However, snowplowing operations were traditionally managed on a large wall map that detailed the city's service areas. Supervisors dispatched drivers to plow streets and bicycle

paths in the service areas in the same way they had been plowed for the past few decades. That is, the supervisors assigned the drivers to successively plow and replot each area during the winter without any consideration of how the routes and snowplowing service might be optimized.



Location allocation optimized snowplowing zones for pedestrian walkways.



"The city's snowplow drivers just followed the same procedures that they had in the past," says Pori GIS specialist Timo Widbom. "It wasn't efficient, and while most roads were plowed regularly, some were plowed less frequently because of their location and the unavailability of specialized snowplows for particular sections of roadway."

In early 2012, Pori entered into an enterprise license agreement with Esri, which allowed the city unlimited access to ArcGIS software and its extensions, including ArcGIS Network Analyst. With greater access to GIS for city employees, Widbom teamed with Aki Kaapro, GIS analyst at Esri Finland Oy, Esri's authorized distributor in Finland, to build geoprocessing models to facilitate snowplowing and provide access to the geodatabase for those public works employees involved in snow clearance.

First, they had to collect specific data on the existing roads in the city. To do this, the entire city was divided into approximately 800 grids, each measuring one square kilometer. All roads and paths within each grid were then visually inspected and categorized. While the city's pavement department maintains the road network in its GIS, there was little information on street care classifications, such as the amount of accumulated snow allowed on a specified roadway before it should be plowed. Street care classifications also include a road's width and its topology, which can affect the snow buildup and the way that the road is plowed. It took more than a year to collect all the required data.

"The data collection process took us some time because we carefully inspected and collected data on all the roads and pathways in each grid, as it was critical to the development of our geoprocessing models," adds Widbom. "The collected data allows us to determine when and how a roadway should be plowed and the type of vehicle that we should use. For example, we use small plows for our bike paths, but our larger roadways sometimes require two plows used simultaneously."

When the categorization of the city's roads and bike paths was complete, Kaapro began to develop the two geoprocessing models. One determines the optimal snowplowing areas, and the other optimizes the routes to and through those areas. The models use a number of factors, including the data previously collected in the inspection of the city's streets and bike paths, street maintenance priority classifications, the type of snowplow vehicle required, and the total number of areas to plow. The first model uses the Location Allocation tool in Network Analyst to create demand points on those areas where snowplow service is required. After the demand points have been determined, the second model uses the Network Analyst vehicle routing problem solver to find the optimal routes to service and plow them. The model also allows multipoint routing and route reordering.

"Time stamps are calculated for each section of an optimized route to provide us with information about the length of time it takes to plow a specified road section and allow us to facilitate an animation of that section," says Kaapro. "Supervisors can then

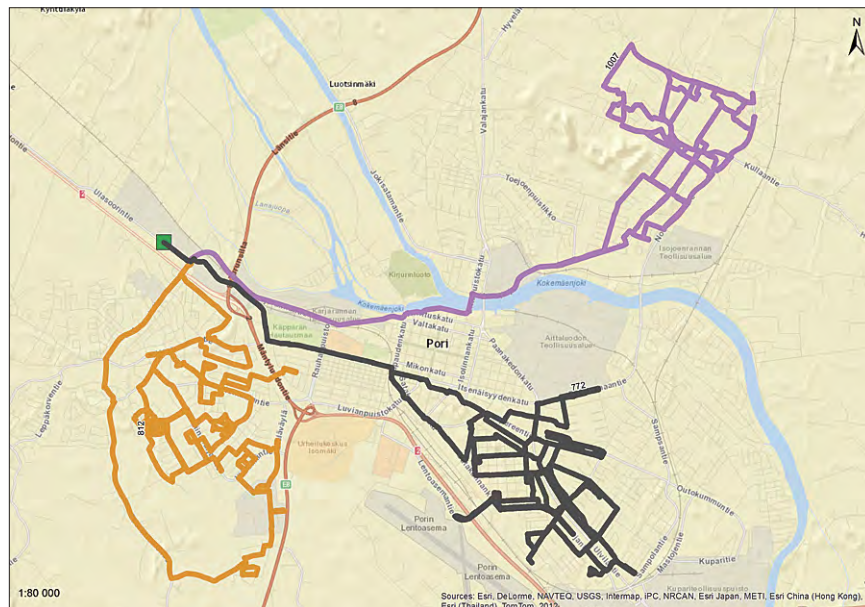
enable the Time Slider window in ArcGIS and discuss the routes with their drivers via the route animation. In addition, there are the conventional means to examine the routes via maps, driving directions, and so on. The main goal is to get the optimized routes to the drivers' mobile navigators."

Widbom has received a positive response from the drivers and their supervisors in the Pori public works department and plans to expand the implementation of the models' results during this year's winter season. In the future, he would like to make the city's geodatabase available on smartphones so that drivers can

interact with the routing assignments from the field and review route history, if needed.

"Our route optimization models will allow us to reduce the overall number of kilometers driven by each snowplow driver while increasing the number of roads each plows," says Widbom. "This provides us with a savings in both time and fuel costs."

(This article originally appeared in the Summer 2013 issue of *ArcNews*.)



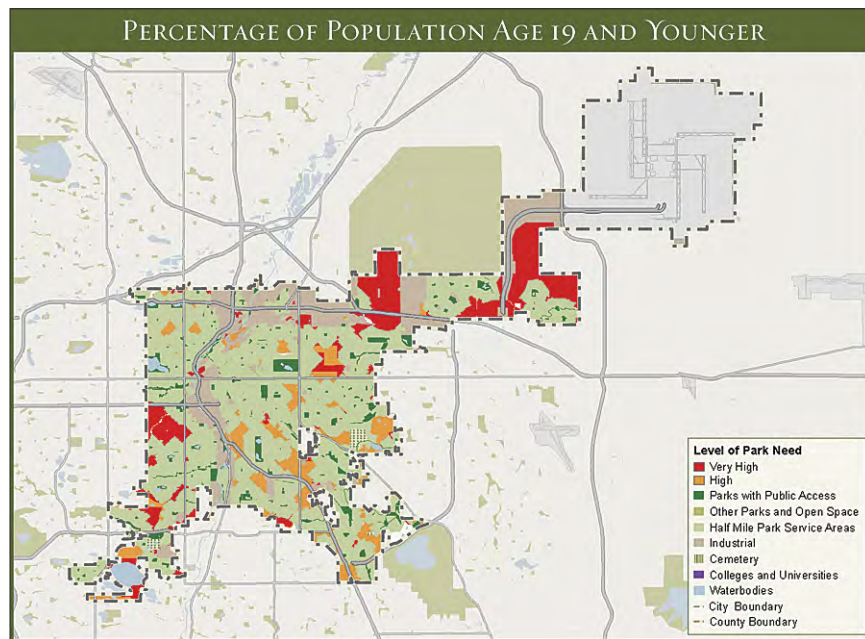
Three examples of optimized snowplowing routes on pedestrian streets.

# Website Helps Discover, Explore, and Improve US City Parks

## Compare Parks and Determine Accessibility

Breece Robertson and Bob Heuer, Trust for Public Land

The 40 largest cities in the United States each have their own character and personality. But one thing that they all have in common is the need for a great park system. Some cities are well on their way to achieving this goal, but others have a great deal of work to do.



This ParkScore map illustrates the level of park need for Denver's children and adolescents by showing the areas of the city with and without park access.

Parks are important to communities because nearby opportunities to exercise and experience nature are essential for physical and mental well-being. Studies show that parks can encourage physical activity, revitalize local economies, and help bring neighborhoods together.

This is why the Trust for Public Land ParkScore Project was developed. ParkScore is the most comprehensive park rating system ever developed and measures, on a scale of 0 to 100, how well cities are meeting the need for parks. The ParkScore website, [ParkScore.TPL.org](https://ParkScore.TPL.org), is free and fully accessible to all. The goal is to empower communities to put more parks on the ground.

ParkScore serves two categories of users. The first consists of individuals and families. The website provides residents with a quick and easy way of seeing their city's park system in detail and allows them to compare their city with others across the United States. This will provide users with both a national perspective on their local park access and the tools to advocate for park improvements in their communities.

The second audience for ParkScore is city planners, park managers, and other local leaders. The website allows these users to dig deep into their city's park system. This helps leaders

better serve their residents by providing them with the tools to jump-start local park system improvement plans. On the website, users can view the following:

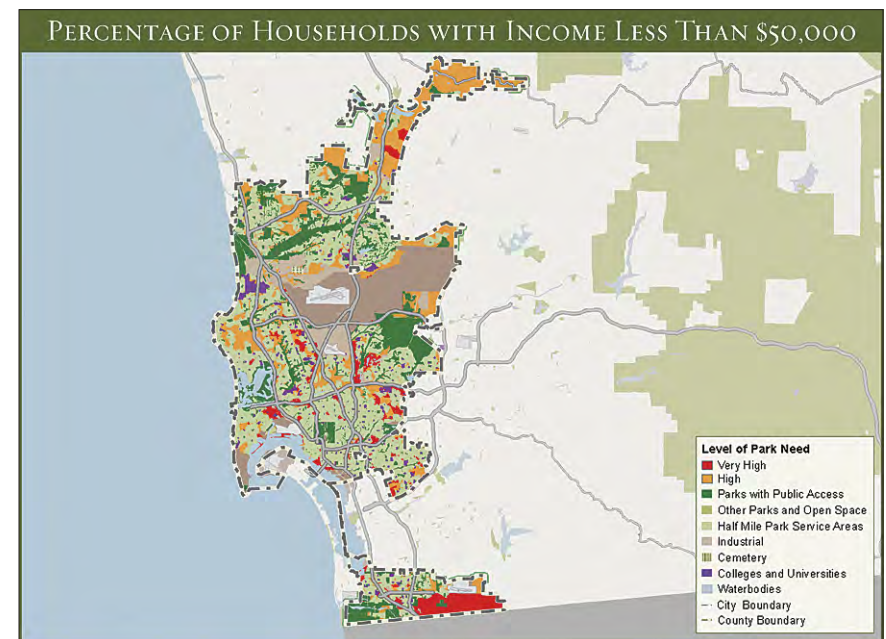
- A citywide analysis of park access by age and income level
- Detailed information about each city park
- Data and analysis pinpointing where parks are needed most critically and identifying which improvements would provide the greatest benefit to local park systems

This kind of information is exactly what is needed to support comprehensive park system improvement programs.

The ArcGIS mapping technology used for this project identifies which neighborhoods and demographics are underserved by parks and how many people are able to reach a park within a 10-minute walk. The Trust for Public Land selected ArcGIS because it provides a robust set of tools and applications for detailed park system analyses and, since it is used by most local governments, allows an easy exchange of information. The ArcGIS platform was also selected because it allowed the creation of walking networks, providing a model for how people walk from their homes and other locations to parks and showing how park access can be increased.

City leaders, such as San Diego mayor Jerry Sanders, are already embracing ParkScore. San Diego's park system ranked 8th among the 40 largest US cities.

Says Sanders, "In San Diego, our parks system is a source of immense civic pride. From our community parks to our hiking trails to crown jewels like Balboa Park, San Diegans love to enjoy our famous sunshine in our public green spaces. We're proud that the Trust for Public Land has recognized our parks on a national level. Like all cities, San Diego has experienced tight budgets in recent years, but as we embark on a recovery, I've already tapped our parks as one of the first places to reap the benefits of increasing revenues. We hope to keep our parks among America's best for years to come."



The level of park need in San Diego for those with a household income of less than \$50,000 is illustrated by showing the areas of the city with and without park access.



Officials in Denver, whose park system ranked 13th, feel the same way. Lauri Dannemiller, manager of Denver Parks and Recreation, says, "We are proud to be opening parks in parts of Denver that have not seen new parks in a generation, and like most cities operating with strained resources, it is partnerships with groups like the Trust for Public Land that make this progress possible."

Joseph Lovell, a senior GIS analyst with Denver Parks and Recreation, says ParkScore's GIS technology makes it a powerful planning tool for city leaders. He continues, "ParkScore is unique because the GIS analysis didn't just measure park access by distance but also factored in whether there were barriers to access, such as a river or a highway, that would hinder park usage. In areas where there is limited park access and land acquisition isn't possible, we're using the ParkScore results to improve connectivity between citizens and existing parks."

The website's ability to offer city leaders a series of solutions and next steps for how to fill the gaps in local park systems that were identified by ParkScore analysis fits in with the Trust for Public Land's four primary services: analyzing local landscapes and identifying where there are gaps in park access, securing funding for land transactions, executing land transactions, and designing and developing parkland once it has been secured.

"You can't have a great city without a great park system," says Christopher Kay, chief operating officer of the Trust for Public Land. "The Trust for Public Land hopes that ParkScore inspires

cities to focus on parks, and we're eager to work with municipal leaders and volunteers to help them build the best park systems imaginable."

#### About the Authors

Breece Robertson and Bob Heuer are with the Trust for Public Land. Robertson is the national director of conservation vision and GIS. She joined the organization in 2001 to create a comprehensive, coordinated GIS program. Heuer is the associate GIS director for the Trust for Public Land. He manages the GIS analysis for ParkScore, as well as a variety of other projects.

For more information, visit [ParkScore.TPL.org](https://ParkScore.TPL.org).

(This article originally appeared in the Winter 2012/2013 issue of ArcNews.)

# Citizen Engagement

The modern municipal workflow to and from the field encompasses data collection and exchange from a variety of sources that includes both authoritative (official) and assertive (volunteered) collection procedures. Volunteered geographic information (VGI) has become an important source of information for reporting incidents and emergencies to a city or county. It promotes civic responsibility by engaging community residents in providing valuable, firsthand information when an emergency strikes. This allows municipal workers to respond more quickly and minimize its impact.

# Smartphone App Aids District's Facilities Maintenance

Jim Baumann, Esri

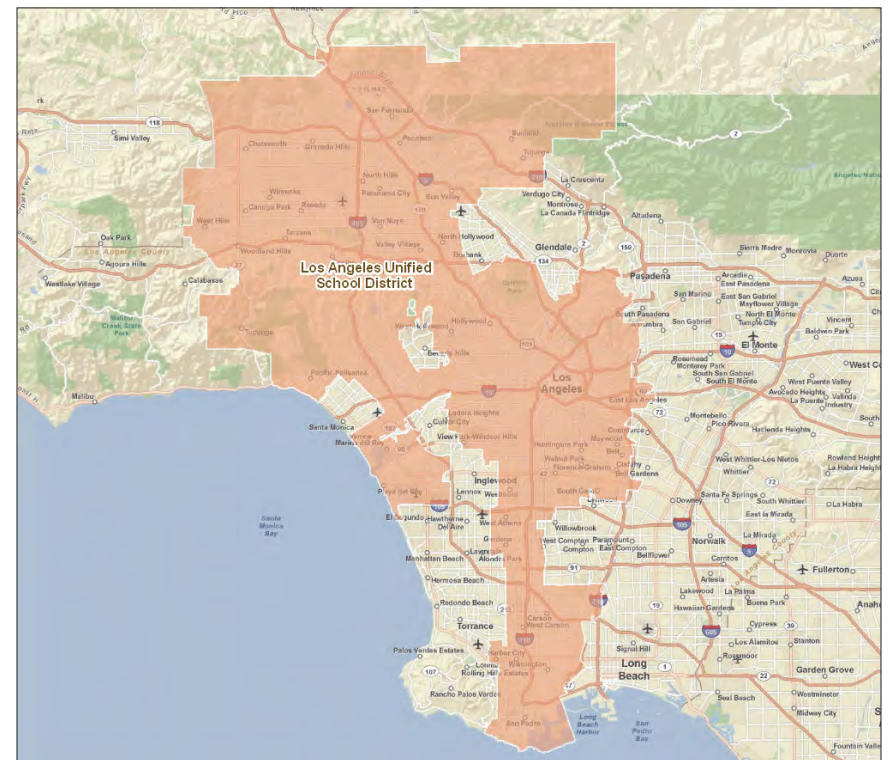
Students and faculty in the Los Angeles Unified School District (LAUSD) can report graffiti, broken benches, or other repair issues using a smartphone application that is integrated with the district's GIS.

LAUSD is responsible for educating more than 675,000 K–12 students annually and is the second-largest public school district in the United States. The district manages facilities that include 1,065 K–12 schools; more than 200 education centers, adult schools, and occupational skill and learning centers; and dozens of warehouses and storage yards within the district's 710 square miles.

The district has used Esri's GIS software since 1990 for [administrative tasks](#) including student enrollment forecasting and analysis, school boundary maintenance, student safety, disaster planning, and facilities operations and management. As additional applications were added, the GIS gradually evolved into an enterprise system.

"GIS has played a big role on the administrative side of our operations," said Danny Lu, business analyst for LAUSD. "As we continued to expand our use of the technology, we realized that

there were some commercial applications that could be easily integrated with ArcGIS and would fit into our existing workflow."



LAUSD, the second-largest public school district in the United States, covers 710 square miles.



A smartphone app integrated with the Los Angeles Unified School District GIS lets students and faculty members report graffiti or other repair issues.

Upkeep of the numerous LAUSD facilities requires an army of administrative, maintenance, and technical staff members who are continually evaluating and processing the many service requests submitted each day. The district implemented a data collection system that allows campus staff to easily report nonemergency issues. This relieves the operations department from some inspection and reporting responsibilities and lets it concentrate on the repair and maintenance of the school district's assets.

In 2010, the district contracted with Esri partner CitySourced to implement LAUSD Service Calls, a smartphone application permitting LAUSD students and faculty to report issues related to the repair and maintenance of school facilities, such as graffiti, broken benches, or damaged sprinkler systems.

"We wanted to take advantage of today's technology and provide our community with an intuitive tool that allows them to easily document maintenance issues and send those reports directly to us so that we can resolve them," said Lu. "As an added benefit, by using the application, students and faculty members of LAUSD are provided with a sense of ownership while building community pride."

CitySourced uses Esri's ArcGIS application programming interface (API) for smartphones in the LAUSD Service Calls application so that the school district can integrate the volunteered data from the incident reports with its authoritative



A user reporting an incident is prompted through a series of steps to specify the incident details and supply a photo.

ArcGIS database. This helps the school district keep the GIS database up-to-date for its IBM Maximo asset management system.

Kurt Daradics, director of business development at CitySourced, said, "The LAUSD Service Calls implementation at LAUSD is an end-to-end solution. Incidents are recorded on the mobile devices and sent to the CitySourced servers hosted by Microsoft Azure. Our servers route the issues directly into LAUSD's IBM Maximo asset management system as service requests, where they are reviewed and subsequently resolved by the district's maintenance department."

Daradics indicated that the LAUSD Service Calls application will eventually be able to automatically query the operational asset layers in the ArcGIS database so that the asset ID can be determined. The ID will then be attached to the asset specified in the incident report submitted by the LAUSD community member. This will allow all information related to the asset (maintenance history, age, and replacement costs) in the GIS database to be automatically retrieved so the school district can use its GIS to better manage and maintain its assets.

The LAUSD Service Calls application can be downloaded for free to the user's smartphone. When reporting an incident, the user is prompted through a series of drop-down lists to specify the incident location, type, required maintenance, and description. This report and accompanying photograph is sent to LAUSD's

asset management system, where it is reviewed by a moderator to determine the required course of action. If maintenance is required, a work order will be generated, prioritized, and routed to the appropriate department for action.

According to Lu, the system also provides feedback to the person or persons reporting the complaint. When a work order is generated as a result of a service call, the asset management system automatically sends a response to the sender, indicating the incident report has been received and assigned. Students and faculty can use the CitySourced application to search for the calls they have placed. Under My Reports, they can view the status of an incident. This feedback loop demonstrates to the community that LAUSD is aware of and is working to resolve their concerns.

(This article originally appeared in the Spring 2012 issue of *ArcUser*.)



# GIS Applied in E-engagement

## A Hong Kong Experience of Citizen Engagement in Public Affairs

Virginia Wan, Esri China (Hong Kong)

Web 2.0 has caused a paradigm shift in the way we communicate and share information on the Internet with the proliferation of web applications, such as social networking sites, blogs, chat rooms, and video-sharing sites. Governments and many public service organizations have captured the essence of Web 2.0 and integrated it into their current infrastructures, which are enhanced to offer more effective and timely services to their citizens. The Washington State Department of Transportation (United States) has pioneered the use of Twitter to deliver traffic information and



Hong Kong, with a land area of only 1,104 square kilometers, has a population of seven million people.

updates. Its use of social networking technologies has facilitated timely dissemination of useful information across different communities. Similarly, Chinese Premier Wen Jiabao also tapped the intelligence of Web 2.0 technology to exchange dialogs with Internet users via two national news portals, [www.gov.cn](http://www.gov.cn) of the central government and [www.xinhuanet.com](http://www.xinhuanet.com) of the Xinhua News Agency, in February of this year.

### GIS Combined with Web 2.0 Engages Hong Kong Citizens in Community Affairs

Engaging community involvement is at the heart of the Web 2.0 concept. Combined with GIS, Web 2.0 technologies present users with added convenience in the global village. Dr. Winnie Tang, CEO of Esri China (Hong Kong) Limited, as well as a district councillor of the Hong Kong Special Administrative Region government, made the first attempt in Hong Kong to use "crowdsourcing" via her personal web site [www.winnietang.hk](http://www.winnietang.hk). The built-in functions of the site help raise public awareness of information and communication technology (ICT)-related community affairs and encourage public sharing of opinions through the online platform.

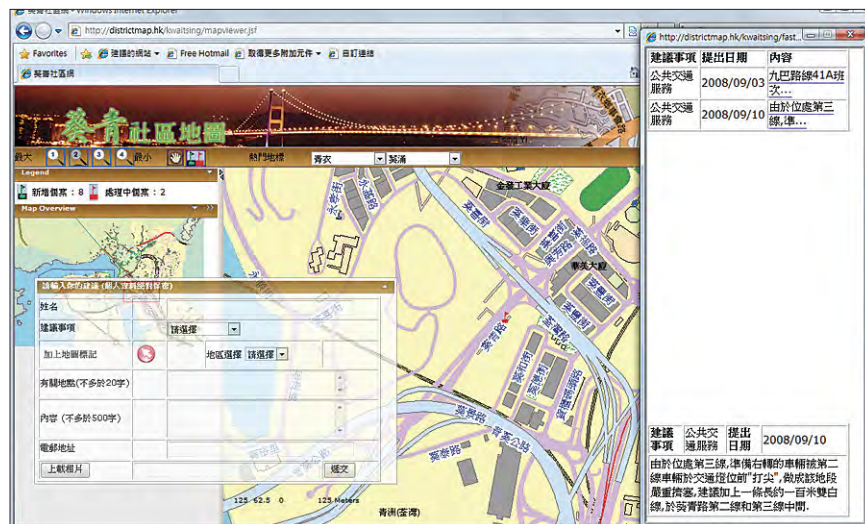
Hong Kong, also known as the "Pearl of the Orient," is located at the southern tip of China. With a land mass of only 1,104 square kilometers (426 square miles) and a population of seven million people, it is one of the most densely populated areas in the world. The city is geographically divided into 18 districts served by individual district councils responsible for coordinating administrative affairs and acting as bridges of communication between the local population and the government. In her role as district councillor for Kwai Tsing District, Tang would very much like to engage the general public to contribute their views and suggestions on district affairs and cultivate a strong sense of a close-knit community. Having a population of more than half a

million in her district, Tang recognized the need for improving efficiency and transparency in the process of governance.

"With over 4.8 million Internet users in Hong Kong," Tang says, "the 70 percent penetration rate ranks us second in household broadband penetration in Asia. Sitting on the Digital 21 Strategy Advisory Committee, I have advised on and advocated Gov 2.0 to our government when Web 2.0 clearly has set the trend and expectation of people in this digital era. I believe Gov 2.0 would set some successful examples."

## Kwai Tsing District Map

In an effort to better serve the growing community with her experience in GIS technology, Tang developed a virtual district council office on the Internet, coined Kwai Tsing District Map ([www.districtmap.hk/kwaitsing](http://www.districtmap.hk/kwaitsing)). Powered by ArcGIS Server 9.2 for the Java Platform and SQL Server, Kwai Tsing District Map not only allows the public to access geographic information of the district but also provides an open platform for posting comments, suggestions, or complaints. ArcGIS Server 9.2 enables the web site to dynamically generate maps with different layers and symbology at different scales, allowing Internet users to easily indicate the exact location tied to an issue or concern. The reported issues' spatial information is stored in SQL Server, using ArcSDE technology, for further analysis.



Users of the Kwai Tsing District Map can point to the relevant locations on the map and provide views and suggestions on community affairs.

ArcGIS allows different layers of information, such as buildings, transportation means, and recreational facilities, to be presented on the map. An Internet user may flag the exact locations and areas of the corresponding issues being reported, which are then verified and validated by the web site administrator to determine follow-up actions. Issues addressed range from public facilities to community safety, transportation services, environmental issues, and recreational facilities. If the concerns prove to be valid, they will be forwarded to the relevant government departments. Blue flags on the map indicate locations of newly reported issues, whereas red flags indicate investigations in progress.

This new way of information sharing has greatly sped up follow-up work by the office of the district councillor with timely and accurate information. Progress of investigation is also posted for public reference on a regular basis. Through the interactive map, the public can check on the status and updates of reported incidents around their community. "I am certainly pleased with this current setup and with favorable feedback from the community," says Tang. "I've been asked to share this experience with other district councillors on this new alternative communication channel."

Compared to the traditional district council offices, which operate during specified office hours, the Web-based, GIS-enabled Kwai Tsing District Map escalates e-engagement, or public participation in community affairs, and collaboration within the district. Kwai Tsing District Map provides an effective and efficient system by which local residents can voice their needs, opinions, and concerns whenever Internet access is available.

The current trend of Web 2.0 has greatly reshaped our expectations as most of us enjoy the social value to individuals and the business value for the private sector. Gov 2.0 is beginning to set a new trend for public figures and politicians to stay connected with the citizens and their supporters. With security, scalability, and interoperability being addressed, crowdsourcing—capitalized to engage the public in community affairs—can bring about broader value and benefits to both governments and their citizens.

(This article originally appeared in the Summer 2010 issue of *ArcNews*.)

# Civic Crowdsourcing Enabled

Matt DeMeritt, Esri

Local governments strapped for funds can take a hyperlocal approach to funding community projects using a new GIS-based application. ZenFunder is a web application for civic crowdsourcing that lets residents help make their community a better place to live by proposing or contributing to projects in their neighborhood.

Monies raised go directly to solving a specific problem instead of disappearing into a general municipal fund. The application is unique in that it allows residents and governments to collaborate. Because cities, elected officials, and neighborhood councils can participate without being charged processing fees, 100 percent of committed money goes to funding projects.

A funding platform like Kickstarter, ZenFunder provides a quicker way to translate a good idea into reality. Built specifically to meet the needs of local government and education, it combines "crowdfunding" with participatory budgeting. ZenFunder makes sure requirements, budgets, and assessments are completed. Organizations that join ZenFunder can use either the free or premium versions. For an annual fee, the premium version provides more robust tools for managing funds.

The screenshot shows the ZenFunder project page for the Calabazas Branch Library. The breadcrumb trail at the top reads: US > California > Santa Clara County > City of San Jose > West San Jose > Books Needed for the New Calabazas Branch Library. The project title is "Books Needed for the New Calabazas Branch Library". A progress bar at the top shows the stages: Proposed (active), Requirements, Approved, Funded, In Progress, and Completed. Below the progress bar, navigation links include Home, Contributors (0), Updates (0), Comments (0), Media (11), Questions (0), and Requirements (0). The main image is a rendering of the Calabazas Branch Library building. To the right of the image is a map showing the location. Below the image, a text block describes the building: "Calabazas is a 10,000 sq ft building, with a floorplan that is very open and well laid out for the library activities. It's opening in June, but we don't have enough funding to stock the library with books and materials!". To the right of this text is a table with the following data: Proposed: Mar 8, 2013; Requirements Met: Mar 8, 2013; Approved: Mar 8, 2013; Funding Deadline: Mar 8, 2014. Below the text block are tags: library, calabazas, books. A large blue box displays "San Jose, CA Matching Funds: \$7,600,000" with "Funds provided by: San Jose, CA" below it. To the right of this box is a fundraising summary: 96% Complete; Goal: \$7,926,090; City: \$7,600,000; Raised: \$0; Needed: \$326,090. A yellow "Contribute" button is present with "Minimum contribution \$5" and "Days Remaining: 360". At the bottom right, a section titled "ZenFund proposed by:" features a profile for Pete Constant, with "Contact Me" and three buttons: "ZenFunds Proposed", "ZenFunds Approved", and "ZenFunds Completed". A final text block at the bottom states: "In preparation for the opening of the Calabazas Branch Library, I am leading the fundraising efforts in partnership with the San Jose Public Library Foundation to raise \$300,000 to stock the library. It is important for residents to know that there has been enough funding set aside to open these libraries, but not enough".

Using ZenFunder, residents can work with government to improve their neighborhoods.

With either version, after a city signs up for ZenFunder, anyone can create a new project. Once a project reaches a minimum funding threshold, it is reviewed by the city. If it is not approved, the money is returned to contributors. If the project is approved, it is posted on the website along with project details, requirements, and community comments. Project locations are mapped so residents can easily find projects to fund that are nearby. Contributions can come from local government, corporate sponsors, and community members.

In recent years, funding for projects that significantly contribute to the quality of life in communities has grown scarce for several reasons. Property taxes, the major source of revenue for most local governments, were adversely affected by the downturn in real estate values that began in 2007 and has still not completely reversed itself, according to a report for fiscal year 2012 issued by the National League of Cities. To fill holes that appeared in budgets, many governments depleted their reserves, which has, in turn, caused rating agencies to downgrade them, making it more difficult and expensive to borrow funds. Funding for local projects through the Community Development Block Grant (CDBG) program is also a less viable alternative. Between 2002 and 2013, total grant expenditures declined 23 percent according to a report issued by the US Department of Housing and Urban Development.

ZenFunder offers an alternative and innovative method for meeting a community's needs. When he first learned about ZenFunder, San José City council member Pete Constant immediately recognized its potential for aiding the city. The first project was raising additional funds to complete the Calabazas Library, which has been closed for remodeling for about two years. Although \$7.6 million had been spent on the structure, no funds were set aside for stocking the library shelves. This project would raise a little over \$325,000 to improve the library's collection. Two other projects, both for pedestrian crosswalk flashing beacons to improve safety at busy crosswalks, have also been proposed.

"ZenFunder is based on the premise that if everyone gives a few dollars, we can fund important hyperlocal projects that directly benefit our community," said Constant. "This is really democracy in action."

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