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GIS Cleans Up LA's Routing Operations



LA's Bureau of Sanitation deployed a GIS (geographic information system)-based routing solution that has recouped more than 200 hours of productivity per week.

Sal Aguilar, GIS manager at the support services division of LA's Bureau of Sanitation's SRCD (Solid Resources Collection Division)



Drivers at LA's Bureau of Sanitation's SRCD (solid resources collection division) are now using GIS-based routing software on Motorola handheld computers.

A teal-colored garbage truck is the background of the page. In the foreground, a person's hand is visible, holding a black pen. The title 'GIS Cleans Up LA's Routing Operations' is written in large, bold, yellow letters across the top of the image.

GIS Cleans Up LA's Routing Operations

LA's Bureau of Sanitation deployed a GIS (geographic information system) that has recouped more than 200 hours of productivity per week.

by Sarah Howland

If you're asked to picture the city of Los Angeles, what image do you see? You may envision the glitz and glamour of Hollywood, imagine all of the stars and attractive people walking the streets, or visualize the beautiful sunshine and palm trees intrinsic to the area. An image that probably doesn't enter your mind's eye is the 1.5 million tons of trash the 3,849,378 inhabitants of LA produce each year. Yes, that's right — 1.5 million tons. Why isn't this staggering amount of trash the first thing you think of? You can thank the city's Bureau of Sanitation, which exists to keep the city clean.

The SRCD (solid resources collection division) within LA's Bureau of Sanitation performs two primary functions — collection activities and container services management. The SRCD is responsible for collecting refuse, yard trimmings, and recyclables from the 2.3 million city-issued containers throughout LA. In addition to regularly scheduled collection pickups, the SRCD employs 60 special collection drivers who collect bulky items such as sofas, washing machines, and refrigerators by appointment. These 60 drivers complete about 55,000 pickup requests each month. The SRCD also employs 20 drivers who issue, replace, and repair containers upon customer request. All requests from the city are handled through the bureau's central call center, which distributes jobs according to the city's six SRCD district yard locations and single container service warehouse.

Not too long ago, the process the bureau used to route its SRCD special collection and container services was a purely manual process. However, this manual process was unable to keep up when many of the 2.3 million city-issued containers began to reach the end of their life cycles, and requests for replacement skyrocketed. At this point, the bureau turned to a GIS to automate its routing process and increase the efficiency of its drivers.

Paper-Based Routing Time Consuming, Manual Data Collection Error Prone

Before the bureau deployed a GIS, calls coming in to the centralized call center were entered into a proprietary database and forwarded to the appropriate district yard or warehouse. The supervisor at the district yard or container services ware-

house then printed out jobs grouped by ZIP code and distributed them evenly among drivers, who were responsible for organizing the jobs in the way they thought made most sense and routing themselves based on their knowledge of the area. While in the field, the drivers were responsible for keeping manual notes on each job, including information on when the job was completed or reasons for jobs uncompleted. For example, if a request for pickup was made but the customer forgot to leave the item out, the job can't be done and the reason needs to be recorded. The container services drivers also had to manually record a 13-digit serial number, used to associate a specific container with a specific address, from each container they serviced.

The paper-based routing and data collection processes the bureau was using presented a few inefficiencies. First, all drivers attended a meeting each morning to obtain a job list for the day and determine the routes they'd take,

all of its GIS initiatives for years, so Aguilar was familiar with ArcLogistics from ESRI. ArcLogistics is a desktop routing solution that comes preloaded with GIS map data from NAVTEQ and optimizes routes based on geocoded customer addresses, estimated drive times between locations, and driver skills and schedules. ArcLogistics would integrate with the bureau's proprietary call center database so that as appointments are entered into the database, optimized schedules and routes are automatically generated for each driver. "While ESRI had a longstanding reputation within LA and was the first vendor that came to mind when I started this project, I wouldn't have chosen ArcLogistics if it weren't the best-fitting solution for our needs," explains Aguilar.

And it was, for the city's appointment-based (or point-to-point) routing. For regular pickup (or continuous) routing, however, Aguilar chose RouteSmart, which is



“The 30 minutes each driver spent going over paper-based routes each morning was productive time we were losing out on.”

Sal Aguilar, LA's Bureau of Sanitation

which lasted about 30 minutes. "The 30 minutes each driver spent going over paper-based routes every morning was productive time we were losing out on," notes Sal Aguilar, GIS manager at the bureau's support services division of the SRCD. "Also, the manual data collection the drivers were doing in the field left a lot of room for human error, especially with the manual recording of 13-digit serial numbers." Not to mention, the data entry work was duplicated by clerks who had to enter all of the drivers' handwritten notes into the bureau's database at the end of each day. "There was a lot of 'is this a 1 or an I?' when it came to the data entry clerks reading the drivers' notes, which resulted in a lot of time spent on this task and inaccurate data being entered into the database," adds Aguilar.

These inefficiencies were compounded when many of the city's containers began to reach the end of their life cycles at once, resulting in a higher volume of requests. When the volume of calls increased dramatically for container services, the bureau decided to implement a systematic container replacement program. Rather than wait for each and every resident with an aging container to call in and make an appointment, the bureau decided to proactively replace each container that was reaching the end of its expected life cycle. However, for this program to work the way the bureau was envisioning it, a more efficient routing system was crucial.

GIS Quells Routing Woes

While Aguilar spent some time researching various routing vendors online, he entered his search with a solution already in mind. LA has used ESRI software for

routing software used mainly in the public works sectors. RouteSmart plugs into the ESRI ArcGIS Desktop (software used to organize and analyze the bureau's GIS data) so it uses the same GIS data as ArcLogistics, but uses its own unique algorithms to accommodate continuous routing-specific needs, including cluster workloads, sequencing stops, side-of-street specific routing, and trips to intermediate facilities (i.e. disposal sites).

Public Works Environment Necessitates Rugged Devices For Mobile GIS

While ArcLogistics and RouteSmart would take care of the challenges of routing drivers more efficiently, the bureau still needed a way to mobilize this information to eliminate the need for paper route printouts for drivers. Further, Aguilar wanted to solve the problem of hand-written notes and manual data collection. To accomplish these goals, he chose another product from ESRI — ArcPad, which also plugs into ArcGIS Desktop. ArcPad is mobile GIS software that would enable the bureau to push out driver schedules and routes directly to a mobile device, as well as allow the creation of electronic forms to enable automated data collection in the field. Aguilar chose Motorola MC70 devices to deploy ArcPad. "Rugged devices are essential in our case," says Aguilar. "The devices are constantly bouncing around in the large garbage trucks, being dropped on the road, etc. An iPhone wouldn't last a week in this application."

Once Aguilar had chosen the components of the solution, installation began. The bureau started with the

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deployment of ArcGIS Desktop, ArcLogistics, ArcPad, and RouteSmart at the container warehouse and each of the six district yards. Aguilar first trained his team of four GIS specialists on ArcGIS, ArcLogistics, ArcPad, and RouteSmart in a train-the-trainer fashion. The team then completed the installation of software at each location, which included loading the software, setting up the Access database interfaces with the proprietary call center database, and providing hands-on training to the users of the software. “The ESRI solutions are out-of-the-box, so they took virtually no programming,” says Aguilar. “Our time was spent loading the software, and then training users on how to properly enter calls and forward routes to the drivers’ mobile devices.” This process took about one month per location.

When the routing solution was up and running, it was time to deploy ArcPad on the Motorola MC70s to the drivers. For this process to begin, however, the GIS team first had to create the customized form drivers would use to complete notes on the job. The electronic form enables the driver to select the stop they’re at, complete a reference number for the call center, enter a resolution code (i.e. job complete, not complete because container wasn’t available, etc.), and for the container services drivers to scan the bar code on each container using the embedded bar code scanner on the MC70.

With the form complete, the GIS team loaded the software onto the Motorola MC70s and began to roll out ArcPad at the first district yard. “We chose the district yard that had the youngest average driver age to deploy to first,” says Aguilar. “We felt the younger drivers would be more accepting of the technology and more apt to provide good feedback, whereas the more tenured drivers who’ve been using the paper process longer would be more likely to have difficulty with the transition.” The GIS team first conducted a 2-hour, classroom-style training with the drivers and office staff of each location to provide an overview of the solution, and then went on ride-alongs with each driver to provide hands-on training on the solution. According to Aguilar, the drivers needed one and a half days of ride-alongs on average before feeling comfortable using the solution on their own. The rollout of ArcPad at each location took between two and three months.

GIS Streamlines Routing, Enables Automated Data Collection

Now, when a customer calls in to the call center with a request for an appointment, the appointment is entered into the bureau’s database, which is imported at end of day to ArcLogistics. ArcLogistics then optimizes routes based on the date of the appointment, the district yard the appointment falls in, and by driver and exports these routes daily to a file for each individual driver that is sent directly to the driver’s MC70. Drivers stop by their base location in the morning to pick up the MC70, and then complete an electronic, drop-down-based form for each appointment they complete. Routes for continuous service locations, created in RouteSmart based on the area that needs service that day and which driver will accomplish which portion, are distributed in the same way. At the end of their shifts, the drivers drop the MC70s back off at their location to sync them,

The Reach Of GIS

When Sal Aguilar, GIS (geographic information system) manager at the support services division of the SRCD (solid resources collection division) of LA’s Bureau of Sanitation, decided to deploy a GIS-based route optimization solution, ESRI was the first vendor to come to mind. “ESRI has a long-standing relationship with LA, is used

for all GIS-based projects, and is seen as the city standard for GIS technology,” he explains. However, ESRI’s reputation alone wasn’t going to sell Aguilar on ArcLogistics, its route optimization solution.

What did sell him? The fact that ESRI’s solutions are able to be deployed out of the box, but



Drivers at LA’s Bureau of Sanitation have replaced manual data collection with an automated process thanks to ArcPad software from ESRI, deployed on Motorola MC70 handhelds.

are also scalable and can be built on over time. “The software has a lot of capability, but you can also keep it simple,” explains Aguilar. “You can use ArcLogistics right out of the box for routing alone, but you can also take it further to analyze route data, determine patterns of when residents set out trash, etc.” For example, now that the bureau has its basic routing automated, Aguilar has also set out to implement the concept of ORBA (operational route-based analysis) on its 2,500+ continuous service routes. ORBA will enable the bureau to look at the operational parameters of the routes and display them spatially to analyze the relationships between them and determine where improvements can be made.

Indeed, the uses for GIS are vast. ESRI provides solutions to a number of verticals other than public works, including military, education, healthcare, agriculture, public safety, transportation, and utilities. Besides scheduling and routing, GIS can be used for navigation, data management and mapping, and market analysis. For more information on ESRI, visit www.esri.com.



Aguilar, along with his team of GIS specialists, performed ride-alongs with the drivers of the SACD to train them on the ArcPad solution deployed on Motorola MC70 handheld computers. Each driver took an average of one and a half days to get up to speed on the solution.

which uploads all of the form information gathered throughout the day to the bureau's database.

While Aguilar did consider enabling the devices with cellular service to allow real-time data transfer versus having to sync the devices, he says the benefit of doing so wasn't worth the added cost, which would be approximately \$34,440 annually for a cellular data plan. "A customer who calls to have a pickup appointment isn't going to call back that same day to check on it; it'll be the next day," he explains. "We aren't in the type of service industry, like break/fix, where people are waiting for us to arrive. The cost of that real-time communication really isn't worth it for us."

Since deploying the GIS-based routing solutions and ArcPad automated data collection, the bureau has eliminated the coordination meetings the teams used to hold each morning. While a half hour may not seem like huge savings, it is when you think about how many people were spending that half hour. By eliminating the 30 minutes its 82 drivers were spending each morning in the routing meeting, the bureau has recouped more than 200 hours per week of productive time. Moreover, drivers are completing 30% more stops per day, which enabled the teams to absorb the increased volume they experienced when many of the containers reached the end of their life cycles at once, without hiring additional drivers. Lastly, the automated data capture solution has eliminated the necessary data entry time and common data entry errors of the paper-based method.

In the near future, the bureau is planning to upgrade to the latest version of ArcLogistics, and Aguilar plans to replace the Motorola MC70s with the newer Motorola MC75A. Aguilar is also piloting a project for the bureau's DAC (dead animal collection) division, which currently uses pagers for routing. He plans to deploy ArcLogistics for routing, ArcNavigator for real-time turn-by-turn navigation and on-the-fly rerouting, and ArcPad for field data collection on the Motorola MC75A, similar to how

the special collection and container divisions do now, but include real-time cellular communication because of the more urgent nature of DAC jobs.

"GIS can play an integral role in any operation," says Aguilar. "The ability to take data that has formerly been looked at in a tabular format and have it be spatially referenced, analyzed, and automatically mapped is a powerful tool that can help any organization." Indeed, Aguilar's point is a valid one — while LA's use of a GIS is a great example of how GIS can be used for routing in a public works application, the reach of GIS is really much broader. No matter what vertical market you're in — or whether your business need is scheduling and routing, navigation, mapping, or business analysis — it is worth taking a look at the role a GIS could play in your organization. ●



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