Building a Modern GIS

For an Ancient City

Founded by Romans in 34 BC and with a current population of 92,000, Cáceres is one of Europe's oldest cities. Recently, a team of three city planners working with a modest budget were able to implement a world-class municipal GIS using existing digital cartography and a variety of existing databases. Many tasks that were slow and tedious are now automated, freeing professionals for more productive activities.

By Angus W. Stocking, L.S.

A sampling of infrastructure maps managed by the GIS of Cáceres (Photo credit: Ayuntamiento de Cáceres)

Cáceres, Spain, is a UNESCO World Heritage City renowned for its blend of Roman, Islamic, Jewish, and Christian cultures and medieval architecture, all of which have left their traces on the city. Founded by Romans in 34 BC and with a current population of 92,000, Cáceres is one of Europe's oldest cities.

But Cáceres is a modern city as well, and its city servants—like their counterparts around the world—struggle to serve citizens efficiently. Recently, a team of three city planners working with a modest budget were able to implement a world-class municipal GIS using existing digital cartography and a variety of existing databases. "The GIS was quickly adopted by the public and has become a daily timesaver for city offices," said GIS Department Director Luis Antonio Álvarez Llorente.

Since there was no budget for outside consultants, the city's planning staff had to develop the GIS on their own. And the databases and cartography that existed had not been designed with a GIS in mind.

Álvarez continued, "Everything we had—mapping and alphanumeric information—was prepared internally. When the project started in 1999, we had some digital cartography that was inconveniently formatted, a lot of paper maps and documentation, and databases in different formats scattered across several city departments. Also, we're very busy so we couldn't assign a lot of staff to this—there were only two technical staff assigned to the project permanently, and occasionally we'd form small, temporary teams for particular phases."

Accessible via the Internet

But if the project's challenges were big, so were its goals. Planners wanted to give all city employees access to the GIS, they wanted it to incorporate all existing databases—along with information from utilities, railways, and highway departments—and they wanted the GIS to be easily accessible to the public via the Internet. To accomplish all this, they broke the project down into phases.

The first phase was to design and organize the GIS. One early decision was to build the new system with Bentley software to take advantage of staff's familiarity with it. MicroStation, MicroStation GeoGraphics, and Descartes were heavily used to assemble the cartographic layers. "We had a lot of our urban planning information on paper so we scanned that for a raster layer and then compared that to digital mapping that were able to import. We adapted and drafted as needed to create base mapping, which gave us a high-quality end product," explained Faustino Cordero, GIS department assistant.

The Cáceres team also turned to dozens of outside sources for cartographic information, including the National Geographic Institute, the Geographic Army Service, historic maps on file at the Cáceres Library, and existing street maps. Most of these were paper-based and required digitizing.

Utility Companies

This base mapping was made available to city staff, and immediately proved useful. The success of this phase encouraged planners and work continued on base layers. Urban and rural cadastral mapping was imported to aid assessors, and orthophotos were adapted and tied to the GIS coordinate scheme.

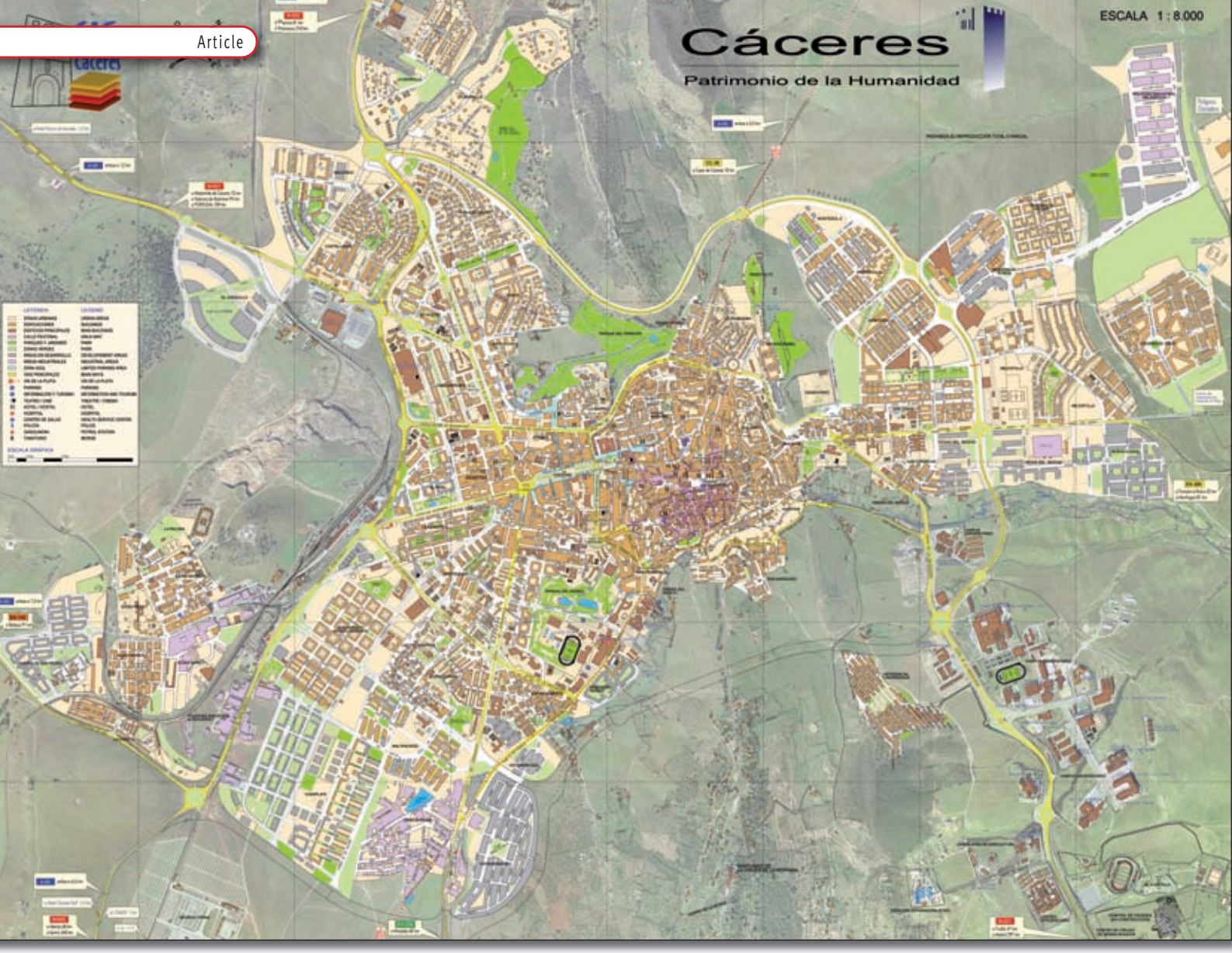
The next phase involved consolidating alphanumeric information—on paper and in databases—in the GIS. Bentley tools were able to work

Wireframe 3D model of the old Cáceres city (Photo credit: Ayuntamiento de Cáceres)

with the various data formats, and staff was able to import paper-based info. Once again, work at this phase was made available as completed and immediately found eager users. "Thanks to the versatility of the software, the available maps and data were easy to consolidate and we've seen a big return on our investment," noted Álvarez.

With the basic format created and most available city information included, the GIS planners turned to outside sources to increase usefulness. Cáceres was able to reach data-sharing agreements with all the utility companies that serve Cáceres, including water, wastewater, gas, and electrical. Cáceres was also able to get digital information about the road and rail networks, which consisted of a total length of

A sampling of infrastructure maps managed by the GIS of Cáceres (Photo credit: Ayuntamiento de Cáceres)



Mainface of the street map printed on paper (Photo credit: Ayuntamiento de Cáceres)

3,000 kilometers of unpaved roads, and have integrated everything into the GIS.

Seeking the most complete and useful information possible, planners continued to add to the GIS, and found ways to import and reference historical cartography, livestock paths, public transportation routes, tourist-oriented street maps, and other information resources. All city buildings are identified, with addresses, useful information like hours of operation, and more than 15,000 total pictures of buildings. Other buildings available for search include pharmacies, health centers, and schools.

Internet Publication

To get this resource on the Internet, the Cáceres team used Geo Web Publisher. "Geo Web Publisher made Internet publication very easy, because we didn't have to transform or adapt anything—we could just use it as we created it," explained Álvarez. But the team did put considerable work into the web interface. VBA and Javascript were used to add functionalities like parcel shading and annotation localizing. Button bars were also created to make the interface readily useable by the public and city employees. In all, 30 VBA modules with a total of more than 5,000 lines of code were built.

Designers have consistently updated, expanded, and improved the Cáceres GIS. Álvarez explained that it's a living thing, currently managing 42,000 archives with more than 50 gigabytes of data and 50 workstations for city use distributed throughout the city's departments. "All the information is centralized and accessible to all departments," noted Cordero. "That way, the changes, updates, or improvements we make are immediately available, not only for the use of public servants, but for the public as well. The power and versatility of this tool is evident from the large volume of data we're able to manage and make accessible".

Álvarez is effusive when speaking to the benefits of the GIS. "We have better control of tax collection and much more ability to answer planning questions. Our census information is much more accurate, and we're able to do more with it. And we can do a lot more for the citizens of Cáceres—for example, we've easily produced more than 50,000 street maps, tourist maps, and public transportation maps," said Álvarez. He added that many tasks that were slow and tedious are now automated, freeing public servants for more productive activities. The system is also a hit with the public, and more than 150 Cáceres residents use it each day.

Cáceres spent 10 years and 1.3 million euros on the GIS project, when all the staff hours, software, workstations, and training hours are taken into account. Several constituencies agree that it was money well spent—the city can accomplish vital tasks more quickly and effectively and take on some chores that were previously impossible, and residents have a resource they can turn to again and again for information.

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