



## GIS at Work in the Building and Zoning Department

By Shannon M. Armstrong

**G**eographic Information System (GIS) technology is an indispensable tool used by government agencies to store, analyze, and display spatial data. Public policy issues such as homeland security, environmental degradation, and urban sprawl have heightened public officials' interest in GIS, making it one of today's fastest-growing information technology systems.

Changes in the industry have contributed to the growth of GIS, including the ability to provide GIS data to a broader audience because of wireless technologies, the availability of software for less technical users, and a decrease in hardware and software costs.

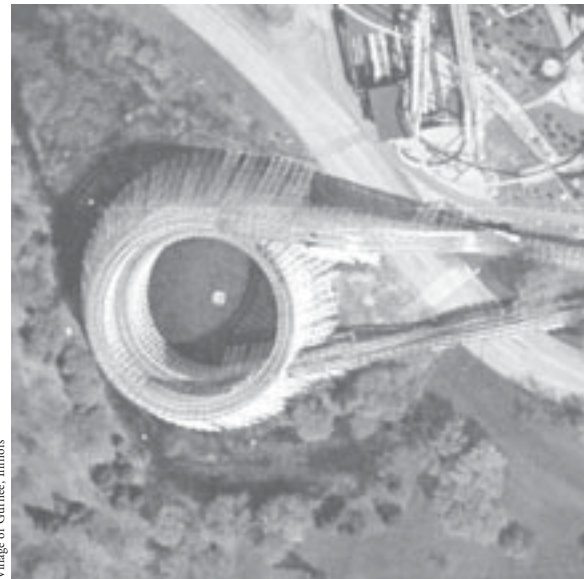
Public policy issues such as homeland security, environmental degradation, and urban sprawl have heightened public officials' interest in Geographic Information System (GIS) technology.

GIS applications are developed to support the functions of municipal agencies. This issue of *Zoning News* provides an overview of GIS development at the municipal level and the utilization of the GIS by a small suburban building and zoning department.

### Building Blocks of a GIS

Great America Theme Park and Gurnee Mills are located in Gurnee, Illinois, a fast-growing suburb north of Chicago. Gurnee Mills, a 1.5 million-square-foot discount shopping center, and Great America, one of several Six Flags amusement parks in the U.S., are located near two major arterials and several highways serving Gurnee and the region. The community's growing population (now at 30,000) and its proximity to Chicago and Milwaukee make it a regional center and an ideal location for retail and entertainment attractions.

In the late 1980s, Gurnee's engineering department created maps of the village by tablet digitizing. Tablet digitizing is the use of a special table with a series of wires that are arranged in horizontal rows and vertical columns. These wires receive signals from a gadget similar to a mouse, called a digitizer cursor. The digitizer cursor allows map features to be traced and saved as coordinate data. A hard copy of a map is taped to the tablet that when traced registers points of known locations. Gurnee's engineering department eventually switched from tablet digitizing to computer aided design (CAD) techniques for mapmaking.



Village of Gurnee, Illinois

*This image of a portion of the American Eagle roller coaster, a dual-track wooden roller coaster complete with a 147-foot drop, at Six Flags Great America, illustrates the visual resolution of the municipality's digital imagery. Scanning resolution, survey control, altitude, and focal length are determinants of image accuracy.*

In the early 1990s, Gurnee's engineering and information systems directors became familiar with GIS and its ability to support the management of infrastructure facilities. The location of infrastructure such as a sidewalk, fire hydrant, or valve can be stored in GIS and located on a map. "Attributes," or details pertaining to a particular sidewalk, fire hydrant, or

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ASK THE AUTHOR

valve, are stored in the GIS database. This allows the information to be searched, put into visual form, and analyzed. The directors knew a GIS system would create a more secure environment for the village's current data. Rather than storing information on paper or relying on institutional knowledge, they felt GIS would help the staff become better organized and allow them easier access to more up-to-date information. GIS would also effectively minimize the likelihood of information being lost, and the staff would no longer have to refer to potentially obsolete county and village maps for requests made to the village.

Orthophotography is often used as a base map for GIS because of its accuracy, resolution, and the detail obtained during the orthophoto production process.

In 1994, after completion of an internal GIS needs assessment, the engineering department took a step toward GIS by obtaining orthophotography and digital mapping. Orthophotography is digital photo imagery covering a large area that is geographically oriented to ground coordinates and offers a controlled photo base to support and enhance mapping applications. Orthophotography is often used as a base map for GIS because of its accuracy, resolution, and the detail obtained during the orthophoto production process. Accurate base maps can be created from orthophotography because the aerial imagery has been assembled so the horizontal scale is continuous. Details such as roads, centerlines, curbs, trees, driveways, and other features of the built and natural environment can be mapped from the orthophotos. They also can be measured off the orthophotography in a digital or paper format.

In 1995, the village hired The Sidwell Company, a St. Charles, Illinois,-based GIS and mapping services firm, to move the municipality's digital CAD map into a GIS. Sidwell's technicians tied the features of Gurnee's digital map to database content with the map tied to a coordinate system. Features such as roads, parcels, or driveways now have a specific geographic location defined in terms of x, y coordinates, such as latitude or longitude or State Plane Coordinate System—another system for defining and locating points on the earth. Mark Kemper, a project manager with Sidwell, says, "Moving a community into a GIS can reveal inconsistencies with data such as PINs [parcel identification numbers], addresses, and water utility identification numbers. It is an excellent tool for checking the accuracy of attributes linked to maps; a tangible benefit of implementing a GIS that is often overlooked."

In 1998, zoning classifications were brought into the GIS by Eric Venden, Gurnee's GIS coordinator. Venden added the zoning classifications for each of the municipality's 15,000 parcels by overlaying zoning classes with the village's tax parcel information. Although there are many data sets within Gurnee's

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Village of Gurnee, Illinois

*The orthophoto production process allows the Gurnee staff to measure the features displayed in this subdivision, including roadways, sidewalks, and lots in a digital environment. The orthophotography is geographically oriented to ground coordinates in the GIS.*



Village of Gurnee, Illinois

*The zoning staff can measure the land uses featured on this georeferenced orthophoto. O'Plaine Road cuts through Gurnee's Public Zoning District, which includes several municipal buildings and facilities, including the village hall to the right of the pond, a portion of the high school's recreational fields, and a library. On the left (west) side of O'Plaine are the library and a vacant site for a new police station, which is under construction.*

GIS—including road edge, street centerline, utility structure locations, floodplains, and wetlands—the main data sources utilized by the building and zoning staff on a daily basis are digital orthophotography, lot area, parcel area, PINs, addresses, and property ownership.

### Minimum Lot Size Verification

Gurnee planner Michael Pruisilla needed to check the municipality's requirements for subdividing residential lots. Pruisilla was specifically interested in obtaining lot areas for several parcels and accessed them by searching the GIS database using PINs. The search provided data showing that several lots within the village's corporate boundaries were substandard. This prompted the municipality to look into determining which residential lots within the municipality did not meet the minimum lot size requirements outlined in the ordinance. The staff was able to determine the location of substandard residential lots by using the GIS. In the past, this could have been a time-consuming process involving different staff accessing paper and digital resources in order to pull together accurate information.

In the GIS, the planner set up a quick query (a set of selection criteria that is built through a tabular select statement) and asked the GIS to locate every lot zoned R-2 that fell below a specified square footage, exempting uses such as planned unit developments and subdivisions. From the query, the planner could pinpoint two major areas within the municipality where the majority of these lots were located, a result of annexation by the county. The municipality is now considering adjusting the floor area ratio of properties zoned R-1 so new homes can be built on the smaller lots.

### Inquiries by the Public or Private Sector

The GIS assists the zoning staff with providing answers to residents, business owners, public agencies, village staff, and elected officials. Most of the requests made are for information regarding parcel data, including zoning classifications, acreage, and services available to a particular parcel or section of the village. Residents typically need to talk to several departments in order to get the information needed for one parcel or location in town. Although each department has different functions and responsibilities, they have common data needs. For instance, the maintenance and location of streets and sewer and water lines are the responsibility of the public works department, but the zoning staff also should have locational information. For example, a staff member in the zoning department can access the GIS to check the status of a sewer line or road and see if they extend to a particular parcel or subdivision.

Often times, other departments, elected officials, and the private sector look to the zoning staff for recommendations on siting a land use. The Gurnee staff received a request from a private enterprise conducting research on the best location for an extended-stay hotel in the village. With a GIS query, the zoning staff was able to locate commercially zoned land of at least 50,000 square feet located near the village's major transportation routes. Without the GIS, the zoning staff would have had to rely on a variety of information sources within the village, with staff people gathering the information.

### Notifying Property Owners and Tracking Variances

In Gurnee, GIS is used to identify "abutter" properties (using a specific range) that need to be notified for zoning review



*In the GIS, the planner created a query to locate substandard lots zoned R-2. Several properties did not meet the minimum lot requirements in Gurnee's ordinance due to annexation in the northeastern portion of the county. Those substandard lots are highlighted in the map in GIS.*

purposes. Furthermore, if the GIS is linked to a specific application, ownership and address data can be used to produce mailing lists and labels.

The Gurnee staff uses orthophotography to look up variances. With the data stored in the GIS, zoning staff can easily access information about ownership and legal descriptions for property, as well as information pertaining to township, street address, and



*All lots within 500 feet of the property applying for the rezoning (in this case from R-2 to R-3) are highlighted in the map. To notify residents of the zoning hearing, a mailing list and letter can be generated for those in the buffer zone.*

## WEBSITE RESOURCES

**www.gis.com.** A general website with a focus on educating the public about GIS technology that is good for beginners. The site provides definitions for GIS terminology, information about how the technology is used in various industries, links to GIS degree programs, and more. Visitors to the website have the ability try GIS at their workstation and download trial or free GIS software.

**www.geographynetwork.com.** Geography Network promotes the communication and sharing of spatial information and services among global GIS users. The website provides free spatial data that can be brought into GIS datasets. It can help users customize an application, and it provides content to help users make maps. Maps, images, and data are available for download and visitors to this website can publish map images and applications on the site to share with other GIS users.

**www.intergraph.com.** Intergraph Corporation, a worldwide firm in operation for more than 30 years, is a leading provider of GIS software, technical assistance, hardware, and system integration.

Intergraph's website offers product and service information, the latest industry news, articles, online manuals, and product installation guides.

**www.directionsmag.com.** *Directions* magazine is an online magazine with articles, editorials, letters to the editor, and columns on the latest in the GIS industry. *Directions* provides directories to GIS user groups, books, events, companies, schools, and libraries.

**www.esri.com.** The largest GIS software provider, Environmental Systems Research Institute, Inc. (ESRI) offers online mapping and GIS training, online courses (some free), software demonstrations, and local government case studies on its website. ESRI has been in existence for more than 30 years, and has more than 100,000 client sites.

**www.gisportal.com.** The GIS portal provides a comprehensive list of links to federal, state, local, and nonprofit GIS websites, GIS job sites, books, companies, and "classic" GIS sites.

PINs for the parcels. They also use the photography to pinpoint a garage from the property line, the setback, and the height of the fence on a particular property. By using building permit-tracking software, staff also can find the addresses and zoning case numbers through their automated catalog system.

### Additional Uses for GIS in Municipal Departments

Other municipal departments can benefit from GIS use. The digital sharing of information will eliminate redundancy, help to establish a common format, organize data, and make it secure. Currently, most municipal departments develop separate systems for filing and database use. Coordination will create a more efficient work environment, better customer service, and eliminate data errors.

### Conclusion

In 2000, Gurnee acquired new orthophotography by having Sidwell acquire new aerial photography. Ideally, communities such as Gurnee, experiencing rapid growth and changes in land use, would have their orthophotography updated every few years. This time, Sidwell flew the village at a lower altitude and used color to capture more up-to-date and refined imagery. Gurnee entered into an agreement with Lake County to share data. The county provides the village with parcel updates and Gurnee provides the county with planimetric and topographic data such as one-foot contours, spot elevations, road edges, street centerlines, and sidewalks.

Future plans in the building and zoning department include linking specific subdivision information, such as building setbacks and fence requirements, to each parcel in the GIS. Eventually, the GIS staff plans on linking the building permit system with the GIS via the PIN. In order to increase the use of GIS among the building and zoning staff, the GIS coordinator is conducting research into web browser software to create a simpler interface for new and less experienced users. "I believe the key to increasing the use of GIS in our building and zoning department, as well as all village departments, is to allow access to the various data sources through one, intuitive interface,"

Venden says. He believes a GIS on an intranet would allow access to many more users at the village hall, and a simpler interface would help encourage staff to enter data as it pertains to their specific department, including building and zoning.

## ZONING Reports

### Telecommunications Real Estate and Permit Acquisition for the 21st Century

*Gregory E. Sweet. Acquire Telecom Services, 955 S. Virginia St., Suite 116, Reno NV 89502. 2002. 204 pp. Available from Planners Book Service. Price. Includes DVD.*

When a cellular developer walks into the planning department with a permit application, do you know why the firm prepares Site A over Site B? Or the differences in technology between PCS and cellular telephones, and the types of systems they require? If not, then this training package is not just for industry professionals seeking sites, but for you as the site plan reviewer and permit granter. Knowing what makes the telecommunications industry tick has become critical knowledge for the practicing planner, and this manual is a worthwhile investment in gaining that understanding.

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