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Geospatial Information Technologies and Urban Management

Heritage Inventory Uses GIS in Cape Town, South Africa

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

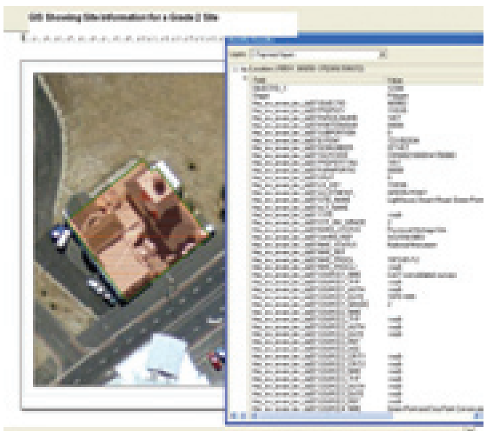
Source: http://www.capetown.gov.za/en/sdf/Pages/default.aspx

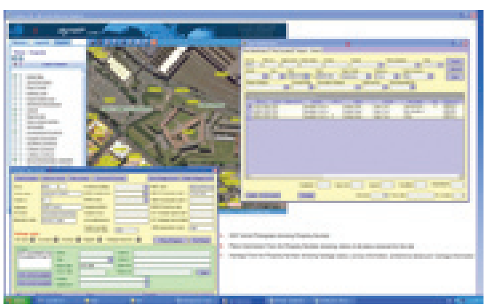
AT ISSUE Cape Town, the oldest colonial city in South Africa, has a wealth of cultural heritage resources, including historical buildings, natural landscape features, and archeological sites. Documenting these resources is critical for understanding the history not only of the city, but also of South Africa as a nation. In 1999, the National Heritage Resource Act (NHRA) called for the "identification, assessment and management of the heritage resources of South Africa" and mandated that local authorities manage and protect their heritage resources for future generations. In particular, it requires local authorities to put a management plan in place when zoning laws change. In 2003, Cape Town initiated a project to consolidate its twenty-six zoning schemes into a single zoning scheme, thus triggering the requirements called for by NHRA.

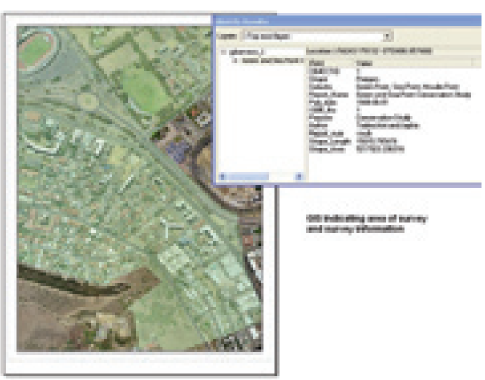
THE RESPONSE In 2006, Cape Town initiated a project to consolidate information from all the heritage resource surveys that had been collected over the years into a single geographic information system (GIS) based inventory for use by the city's planning and environmental management staff. Information from thirty-eight heritage surveys and 300 reports on individual assets were reviewed, edited, and compiled into a centralized computer system. The challenge was to integrate a large volume of survey information that came in many different formats (paper maps, CAD drawings, existing geospatial data layers, electronic lists, publications, and hand-drawn surveys) and that had to be scanned and digitized.

To meet this challenge, the city decided to use GIS technology for the development of its cultural heritage inventory. The customized mapping capabilities of GIS were needed to help municipal staff understand the spatial and environmental characteristics of the resource locations. For example, staff may need to examine how a historical building was positioned within a neighborhood and how that building fit into the context of the neighborhood's architecture. Also, putting the inventory into a GIS could provide tools that would make sharing spatial information across networks relatively easy.

The project began by capturing data and building electronic data files from features on paper maps. It included current heritage structures, administrative boundaries, vegetation and landscape attributes, and designated placeholders







for heritage sites to be surveyed in the future. Much of the data were verified using remotely sensed imagery. The inventory was also linked to the city's systems for land information, land use management, and building development management. Integrating the information in this manner maximized the ability of municipal staff to consider the impact on heritage resources when planning for development and infrastructure projects in the city.

With the development of the inventory, Cape Town has a means for better protecting and managing its heritage resources. The project not only enabled the city to develop a sound conservation plan, but also ensures compliance with relevant national and provincial legislation. By linking the heritage inventory to other relevant city GIS applications, Cape Town has streamlined its service delivery for economic development purposes while also conserving its natural and cultural resources for current and future generations to appreciate.

Excerpted from "Development of the City of Cape Town GIS Heritage Inventory," a paper by Clive James, City of Cape Town, and Lorraine Gerrans, BKS Engineering and Management, accessed October 2008: http://gis.esri.com/library/userconf/proc07/papers/papers/pap_2025.pdf

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Geospatial Information Technologies and Urban Management

Bahrain Adopts GIS for Municipal Functions

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AT ISSUE There are more than 400 lands in the Kingdom of Bahrain that are governed by five different municipalities. To make the best use of government funds, Bahrain needed a system that would allow it to share and coordinate delivery of services to its citizens across multiple administrative boundaries and property lines. After developing a strategic business plan in 1997, Bahrain invested in GIS technology. Since then, many GIS applications have been put in place to improve municipal performance. The shared services model adopted by Bahrain avoids the redundancies an independent GIS program for each municipality would create and a central information systems directorate (ISD) serves all the municipalities in a coordinated fashion.

THE RESPONSE ISD opted to develop its GIS program as a central enterprise system serving all the municipalities rather than create an independent GIS program for each. This design requires sharing information, activities, and experiences across the local jurisdictions as well as linking to data maintained by several national ministries. Because ISD provides technical support to all these units of government, it has been able to coordinate and systematically build the immense network required to run such a centralized system.

In Bahrain, the data required for building municipal services maps were found in various ministries and agencies, and the data came in various formats. ISD had to not only collect numerous data sets, but also harmonize and reformat the data so that they could be integrated into the central GIS for analysis. ISD also established a process to ensure that data sets are updated regularly, based on predetermined time periods for each base map. For example, address data are updated daily as the municipalities issue new addresses to the public.

GIS applications for the municipalities focus on utilities and municipal services. ISD has developed a map browsing system that allows the user to create a customized map of the city—for example, one that shows street locations in relationship to utility services or other criteria as defined by the user. Other applications include a land and property management system, an advertisement management system that tracks the location of billboards and other types of public space advertising, an address management system, a management system for small land parcels, and a municipal investment information system. Many of these applications, originally designed for use by

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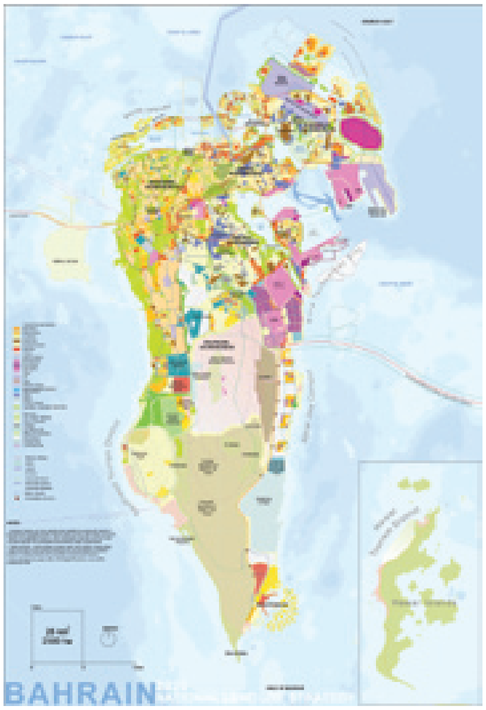

Source: Municipality of Bahrain Official website: http://websrv.municipality.gov.bh/ppd/images/maps/SOM_bahrain.jpg

municipal staff, have been made available to the public via the Web, making it easier for residents to access needed information about their municipality.

The municipal GIS program in Bahrain has grown in popularity. Training and awareness programs on the various GIS applications have been conducted by ISD for all the municipal staffs, which include more than 500 GIS users. The municipalities have realized the significant advantages of GIS, including increased efficiency of public service delivery and cost saving from those efficiencies.

Excerpted from "Effective Use of GIS in Bahrain," a paper by Mohammed Noor Al Shaikh, Assistant Undersecretary of Common Municipal Services, Ministry of Municipalities and Agricultural Affairs, Kingdom of Bahrain; N.V. Kumar, Head of GIS Information Systems Directorate, Bahrain; and Rajasekar, System Analyst, Information Systems Directorate, Bahrain, accessed October 2008: http://www.mapmiddleeast.org/magazine/2005/jul_aug/effective.htm

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Geospatial Information Technologies and Urban Management

Local Government Goes Mobile in Dongcheng-Beijing, China

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

AT ISSUE China's surging economic growth over the past two decades has led to rapid urbanization, which comes with immense challenges for city management. In Beijing, city administrators and citizens alike were frustrated by the government's inability to resolve problems in a timely fashion. Among the concerns were street lighting, drainage, water supply facilities, underground pipelines, housing, gardens, construction, environmental protection, and the general appearance of the city. When municipal employees conducted field visits, they fulfilled only their assigned tasks. Other problems found during the visits went largely ignored. While an employee might note a problem in a report, the information was not used in a systematic fashion that facilitated corrective action. A general lack of integration among highly specialized departments further exacerbated the situation.

THE RESPONSE Dongcheng, an urban district located in the heart of Beijing, implemented a small pilot program using geographic information system (GIS) and global positioning system (GPS) technologies to "reinvent" the business of government. District staff divided the entire jurisdiction of Dongcheng (just over 25 square kilometers) into 1,652 cells and assigned a code to each cell. They conducted a thorough survey of all the public facilities in the district and mapped the facilities in the new GIS. The program also identified four levels of responsible entities: district government, ten neighborhood committees, 137 residents committees, and various public institutions throughout the district. Having these different types of data available in the new GIS enabled the city to quickly and easily locate where problems occurred as well as determine which entity had responsibility for resolving each one.

To support actual implementation of this new technology, the district government established a new Supervision Center and a new Command Center, both of which are independent of the municipal administration. The Supervision Center recruited 400 supervisors, each of whom is responsible for about twelve cells or an area of about 180,000 square meters. The supervisors patrol their assigned areas to look for and report problems, which are registered using a smart mobile phone that records the GPS location of the problem. Photos of the problem can also be sent to the center if needed.

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Using smart mobile phones in the field, an employee reports problems back to the Command Center.

Source: SONG Gang, Department of Information Systems, London School of Economics and Political Science

The Supervision Center provides a report to the Command Center. With more accurate information about the nature and location of a problem, the Command Center can assign a work crew to resolve it.

The smart mobile phones allow the center to monitor the location and working status of all supervisors through a radio service network. The Supervision Center takes phone calls about problems from the public. The mobile phones allow the Supervision Center to contact supervisors in the field and instruct them to investigate the problems reported. Supervisors can send additional information back to the Supervision Center with a recommendation for action. After the problem is solved, the supervisor visits the location and confirms resolution of the problem with another photo. A final report closes the issue in the system.

The mobile government initiative in Dongcheng-Beijing has improved relations between the municipal administration and citizens by bringing much-needed organization and tracking to the delivery of government services. Implementation of mobile government has also transformed the work culture among the municipal staff. A multi-disciplinary, multi-department task force was formed to lead the new initiative. The task force not only provided technical expertise and developed an inventory of public infrastructure and facilities; it also established a new organizational structure to support the new streamlined process for addressing problems. As a result, local government employees no longer stay in the office to process information but instead spend more time on field visits working to resolve problems.

The success of the pilot project in Dongcheng has attracted considerable attention from other municipalities throughout China. In Beijing, seven other urban districts have adopted similar systems. By the end of 2005, all eight urban districts were divided into 10,054 grid cells covering an area of 304.5 square kilometers. Information from surveys of 1.37 million public facilities has been entered into the database. A total of 4,600 smart phones have been purchased by Beijing and have been distributed to 1,706 supervisors in the districts.

Excerpted from "Mobile Government: Towards a Service Paradigm," a paper by Gang Song and Tony Cornford in the Proceedings of the 2nd International Conference on e-Government, 2006, University of Pittsburgh, accessed October 2008: http://www.mgov.cn/ICEG_2006_paper.pdf.

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Geospatial Information Technologies and Urban Management

Land Ownership and GIS in Jordan

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

AT ISSUE The Jordan Department of Lands and Survey (DLS) is the national agency responsible for the management and control of all aspects of land ownership. The agency's responsibilities include registration of land property rights; settlement of land ownership disputes; field survey work to delineate property boundaries; development of cadastral maps that document the location, shape, and size of land properties; and the archiving of all legal documents related to land ownership.

The amount of data associated with the country's land management system is immense. Maintaining and updating the data are of critical importance for the economic health and vitality of the country. As urban areas grew, so did the volume of cadastral maps. In the mid-1980s, DLS management began exploring possible solutions for their ever-increasing data management problems.

THE RESPONSE In 1987, DLS began a large-scale conversion of all of its land ownership data records to digital form for inclusion in a central computer database. Agency management decided to implement a geographic information system (GIS) because the application software provided a tight link between map representations of land parcels and the corresponding ownership and property transaction records in the database. Another advantage for adopting a GIS solution was that it directly complied with a national plan to develop a GIS-based land information system for Jordan. DLS could provide the cadastral layer for this system without major conversion or manipulation of its in-house data structures.

GIS staff started converting paper cadastral maps to digital format. During the first year of the effort, 5,000 paper maps were converted, updated for accuracy, and stored in the national cadastral database. However, because of the large number of maps, around 23,000 in total, more resources were required for the conversion activity. A large-scale project to accelerate the conversion of the remaining 18,000 hard-copy map sheets was started in 1995. The conversion operation involved forty-five workstations in addition to scanners, plotters, and printers and employed more than sixty operators and specialists.

The cadastral map conversion effort was intensive in terms of the time, resources, and personnel involved. However, it moved the DLS from semi-manual processing of land ownership updates to a new era of

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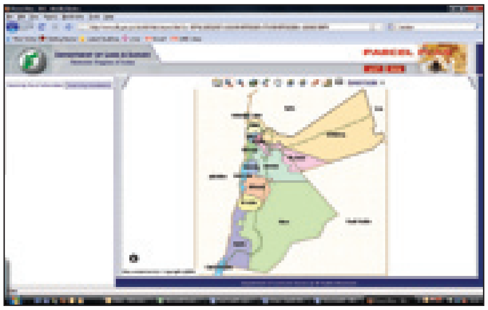

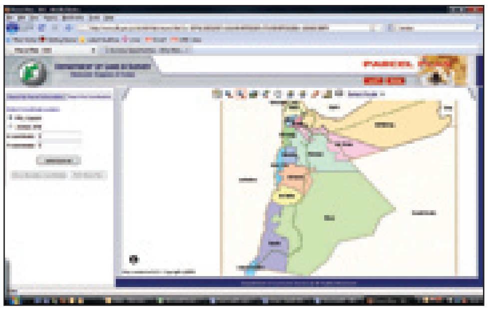

Source: http://www.dls.gov.jo/

computer-based transactions, ensuring faster and more accurate service. The project also enabled DLS to establish a central repository for land data and information needed by municipalities and public utilities. In doing so, DLS secured and protected property ownership rights by recording transaction data in a system that made manipulation of data easy. The GIS enhanced the quality of the cadastral maps by using the digital copy for fixing boundaries and recording parcel transactions.

Thirty-one land registration offices are distributed among the major cities, towns, and urban centers throughout Jordan, and the GIS program allows transactions to take place at these local offices rather than at a national office. This arrangement enhances the speed and accuracy of the operations and ultimately provides better service to the public. The GIS program in Jordan has additional benefits. For example, it has reduced the damage to historical paper maps that resulted from frequent handling during manual processing of transactions and services. It also has prevented unauthorized updates of hard copy maps, due to unintentional human error or, in some cases, fraud.

Excerpted from "GIS Implementation at Jordan Department of Lands & Survey," by Mahmoud Amer, Director of Computer and Information Center, Department of Lands and Survey, Amman, Jordan, accessed October 2008: http://www.gisqatar.org.qa/conf97/links/j3.html

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Geospatial Information Technologies and Urban Management

GIS Estimates Financial Impacts of Municipal Annexation in Cobb County, Georgia, U.S.A.

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

AT ISSUE Cobb County, Georgia, U.S.A, is a suburban area with a population of more than 608,000. Six separate municipalities—Marietta, Powder Springs, Acworth, Smyrna, Kennesaw, and Austell—are located in the county. Each one must petition the county's board of commissioners to annex unincorporated areas of the county into its municipal boundaries. Because the county and city governments are distinct and independent bodies, each approved annexation petition translates into an overall revenue loss for Cobb County. When a petition is approved, the county no longer receives revenue from property taxes and building permits for the annexed land. These revenue streams instead go to the annexing city. However, the county still has the responsibility to maintain roads and schools, provide potable water and waste removal services, and ensure law enforcement and emergency response for county residents. While some of these costs and services are absorbed by the annexing city, the net result is a higher cost to the county government.

Annexation by the six municipalities over a ten-year period has resulted in a 4 percent decrease in land (approximately 14 square miles) and 6 percent decrease in population (approximately 36,000 people) in the remaining unincorporated areas of Cobb County. The annual revenue loss compromises the ability of the county government to provide the same level of services to its residents at the same cost.

THE RESPONSE To help the board of commissioners evaluate the financial and service delivery impacts of each annexation petition, the Cobb County geographic information system (GIS) staff developed the Municipal Annexation Model. The model measures the economic impact of each proposed annexation and calculates the potential revenue loss for each annexation petition. The concise reports help policymakers understand the full financial impact of their decisions.

To build the model, Cobb County began by identifying various revenue streams that are affected by the annexations, including the general fund, fire fund, and E911 fund (emergency call response). The general fund category includes business license fees, building permit fees, cable television franchise fees, and miscellaneous permit fees. The E911 fund category includes E911 system fees, and the fire fund category encompasses real property

Source: http://www.cobbgis.org/rm/

tax, personal property tax, and motor vehicle license fees. In addition, the county collects building permit fees for every unit of building permitted for development in the county.

The county provides services to each of the municipalities located within its boundaries, but these services vary. The county may provide E911 service to one but not to another. The model takes these differences into account and calculates financial impact based on several pre-set formulas. For example, E911 fees are calculated based on the projected number of households in the area to be annexed and the number of phone lines per household. Similar formulas are used for calculating motor vehicle property fees and cable TV franchise fees.

The model produces a map of the annexation area, the location of the annexation area relative to the county boundary, and a summary of the potential financial impacts of the annexation. The analysis also indicates the tax rate difference between the county and the annexing city and reports the difference as a percentage.

The next phase of the model will incorporate other impacts for the county. Water system and transportation infrastructure will be analyzed, as will environmental and social impacts, including impacts on emergency call response time and crime rate variations. Eventually, quality of life comparisons, such as density rates, will be incorporated into the model.

Excerpted from "Using GIS to Estimate Financial Impacts of Municipal Annexation," a paper by Christian U. Okeke, Programmer Analyst, Geographic Information Services; Ed Biggs, Manager, Geographic Information Services; and Judy Sheppard, Business Manager, Information Services, Cobb County (Georgia) Government, accessed October 2008: http://gis.esri.com/library/userconf/proc02/pap0657/p0657.htm

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Geospatial Information Technologies and Urban Management

GIS Supports Crime Analysis in Karachi, Pakistan

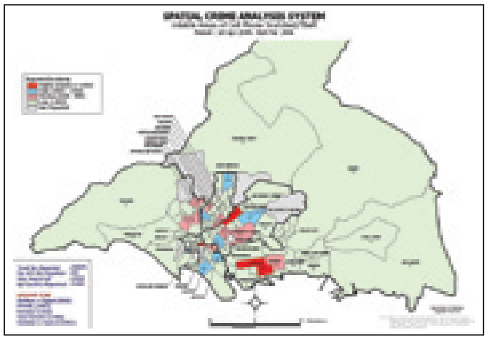
Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

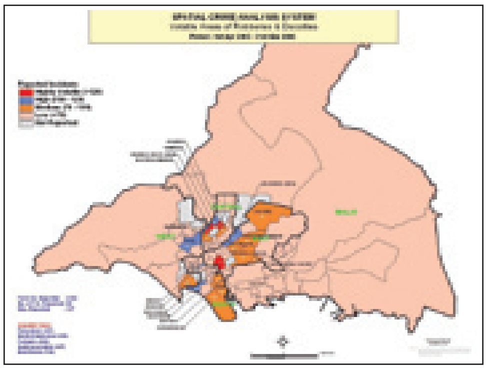
AT ISSUE Karachi, Pakistan, is a coastal mega-city with a population of 14 million. The city's extensive *Katchi Abadis* (squatter settlements), where poverty is rampant, have exceedingly high crime rates. Karachi's Citizen-Police Liaison Committee (CPLC), formed in the late 1980s, recognized that crime had a spatial component. Certain areas of the city had higher crime rates than others. However, in an extensive, unplanned city like Karachi, the street addressing system is at best confusing and often nonexistent. This situation presents a major problem for law enforcement agencies when responding to incidents. Often, the only directions for arriving at a crime scene come from local knowledge or landmarks known to the authorities and the general populace. Navigating through the city and understanding its street layout was a challenge.

THE RESPONSE Using geographic information system (GIS) technology, the committee oversaw the development of a spatial crime analysis system (SCAS) to map reported crime incidents. The SCAS project was designed in two phases. The first involved the development of a customized digital street map of Karachi. The second involved database development, systems integration, and applications implementation.

Street maps are commonly available in most major cities throughout the world. However, Karachi did not have such a resource. No accurate, up-to-date street maps existed in hard copy or digital format. The only existing city map was a nearly decade-old tourist guidebook consisting of 334 pages of 1:10,000-scale street maps published by the Survey of Pakistan in 1990. These maps were produced using aerial photographs and surveys that were conducted in the 1980s. Due to rapid urbanization, these data had limited value, since Karachi has changed radically over the last decade. The Survey of Pakistan, therefore, authorized the updating of the street database.

The comprehensive annotation of the street database ultimately used information derived from the tourist guidebook, official documents, and local knowledge of police officers. The project scanned maps from the guidebook and converted them into digital files. The files were edited and merged to create a contiguous street database for Karachi. Field teams were dispatched to locations throughout the city to collect control points using a global positioning system (GPS). The field teams also verified that features on the map corresponded with existing features on the ground.





Source: Government of Pakistan, Spatial Crime Analysis System.

The street database obtained from the guidebook covered only 70 percent of the urbanized area of Karachi, but police jurisdictions extended far beyond this coverage. Expanding squatter settlements dwarfed the formal development of urban growth. To address this problem, the project team obtained a high-resolution satellite image from 1994 that covered the Karachi metro area. The visible urban details facilitated mapping at the 1:10,000 scale, the same as the street database. Now the database has more current information to reflect recent urban growth and the actual police jurisdictions of the city.

The project team also adopted a standard operating procedure for identifying and classifying landmarks. Combining the new imagery with the physical locations of landmarks and features of the squatter settlements enabled GIS technicians to integrate more than 5,000 unique landmarks into the street database in a two-week time span. Including landmarks in the database is important because they help people identify the location of crime incidents.

The names and locations of more than ninety police stations throughout Karachi were also added to the database. While each police station had a defined theoretical Police Station Jurisdiction (PSJ) boundary, the actual boundary was unclear in practice. The PSJ boundaries had been determined from a crude wall map at police headquarters, but their alignment with the exact physical location of boundaries caused considerable confusion. This ambiguity led citizens to complain of being sent from one police station to another to report a crime. A consultative process finally led to the creation of a PSJ geospatial data layer, which can be modified as needed. In addition to establishing new police jurisdiction boundaries for the database, the project team also defined administrative boundaries by dividing Karachi into south, central, east, Malir, and west districts. Organizing the data in this way helped the city to better manage the information in its geospatial database.

Using one year of crime data, Karachi created maps of crime patterns within the city. The maps combine the new street database, the boundaries of the police jurisdictions, and the corresponding crime records stored in the main police crime incident database. The project has enabled the city to streamline its operational procedures, resulting in more effective deployment of police patrols for crime prevention and for responding quickly when crimes are reported.

Based on "ArcView GIS Supports Crime Analysis in Karachi, Pakistan," a paper by Roman Pryjomko, United Nations Development Program Consultant and International Land Systems, Inc., accessed October 2008: http://pbosnia.kentlaw.edu/projects/warcrimes/gis/victor/articles/pakistan.html. Adapted with permission from Family Health International, Arlington, Va. Not for reproduction or distribution for commercial gain.

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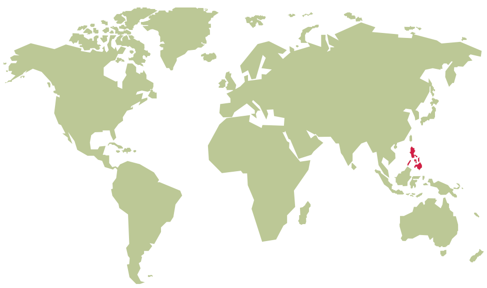
Geospatial Information Technologies and Urban Management

Ormoc City, the Philippines, Uses GIS for Planned Growth



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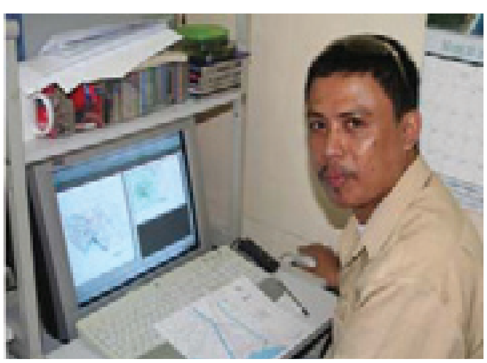

Source: "The Use of GIS In Ormoc City" (URL is cited in the source note at the end of the case).

AT ISSUE Ormoc City serves as a regional hub of economic activity in the Leyte Province of the Philippines. Once a small town with dirt roads, Ormoc City transformed into a highly industrialized community with a thriving commercial sector in the 1950s. As a consequence of this rapid urbanization, however, massive deforestation occurred in the surrounding countryside. When a flash flood hit the city in 1991, the lack of forested lands and ground cover to absorb the excess water resulted in considerable loss of life and damage to property.

The city designated several resettlement areas, including the areas affected by the flash flooding. The resettlement areas are spread over 18.4 hectares throughout nine *barangays* (small administrative divisions or wards). Reconstruction of Ormoc City after this disaster required rebuilding infrastructure support facilities, reforestation projects, resettlement facilities, and systems for drainage, water, and lighting, as well as providing social services for Ormoc's residents.

THE RESPONSE Quality of life is a top priority of the city's leadership, and city leaders regarded planned growth as a strategy for ensuring a high quality of life as Ormoc City rebuilt. Local government staff adopted geographic information system (GIS) technology as a means for guiding the city's growth, particularly for building critical infrastructure and updating utilities and facilities. In 1998, the city first used GIS technology to prepare an urban land use plan. The new technology quickly spread to other local government departments, including the assessor's office, the planning and development office, and the engineering office.

The city has adopted an enterprise approach to GIS and intends to develop new applications for use throughout all local government departments. For example, the city has developed GIS applications for business permits, tax assessments, water billing, and procurement systems. The city emphasizes the importance of sharing data and builds data sets that can be used by multiple departments.

While the primary focus of the city's GIS program has been to strategically plan roads and buildings, the technology has proved useful in many other ways. For example, because it delineates watersheds, forested areas, and

Source: "The Use of GIS In Ormoc City" (URL is cited in the source note at the end of the case).

agricultural lands, it is being used to determine optimal locations for rice fields and sugarcane plantations to achieve greater efficiency in food production. The city is also using it to determine actual land use throughout the region in efforts to develop a comprehensive land use plan. Interestingly, the GIS has even helped to resolve boundary disputes between property owners and between local governments, such as Ormoc City and the nearby municipality of Kananga.

One new GIS application under consideration is a study to determine the feasibility of using nearby Lake Danao to supply water for the city. Ormoc City officials also plan to use GIS technology as a counter-insurgency tool for the army. Through mapping the local terrain and identifying different types of ground cover, army officers can determine likely locations for encounters with insurgents. City officials believe GIS technology gives the city an advantage in their plans for economic growth, and they will continue to explore how the technology can better help the city grow.

Excerpted from "The Use of GIS in Ormoc City," chapter 4.01.02 in *The GIS Cookbook for LGUs,* accessed October 2008: http://www.cookbook.hlurb.gov.ph/4-01-02-use-gis-ormoc-city

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Geospatial Information Technologies and Urban Management

GIS Helps Rebuild Local Governance Capacity in Southern Sudan

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

AT ISSUE Following a twenty-two-year civil war, a peace agreement reached in 2005 between the government of Sudan and the Sudan People's Liberation Army provided partial autonomy to the southern ten states in the country. With the formal establishment of the government of Southern Sudan, citizens who were displaced by the war began returning to their homeland. Much of the country was in disrepair. Among numerous challenges, the new government was faced with rebuilding local communities for long-term sustainability. It needed a systematic process to help manage development projects and infrastructure construction.

THE RESPONSE To build the government's capacity to address these challenges, a Strategic Participatory Town Planning Initiative was developed through support from USAID. Since local officials identified mapping and surveying work as important tools for rebuilding, the initiative incorporated geographic information system (GIS) technology in three areas: community assessments, city mapping, and advanced training in GIS.

Community assessments were conducted to help community leaders determine where to begin with their plans for the future. They created an inventory of available resources (such as transportation systems and other existing infrastructure as well as local government processes and systems, such as land tenure and other municipal records for doing business) and identified strengths and weaknesses of the current systems. In 2005, the new government designated Juba as the regional capital of Southern Sudan. The assessment conducted for Juba and other districts used GIS to create maps that ultimately provided crucial information for community planning and protection of environmental resources. In particular, the Juba Assessment Report provided preliminary recommendations on planning and protecting key areas within the town and along the Nile River corridor.

Maps of communities were created with information about existing structures, key features, natural areas, population density, and transportation routes. The map data were recorded and stored in a GIS to allow for future analysis of town planning options for infrastructure, housing needs, and natural resource management infrastructure.

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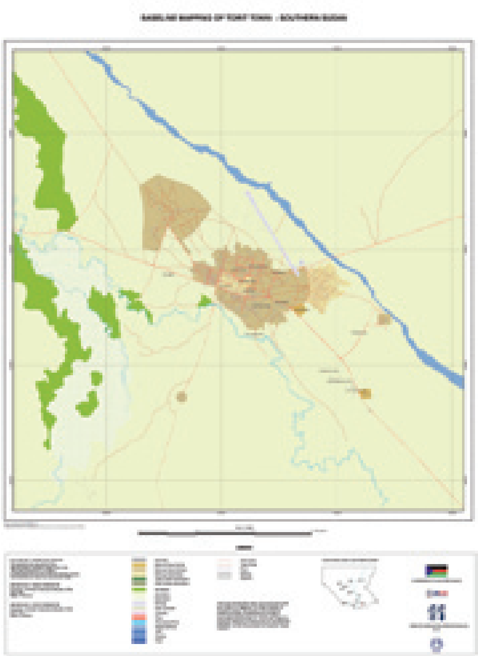
Source: http://www.southsudanmaps.org/Bentiu.html



Source: http://www.southsudanmaps.org/maps/Torit/JPEG/torit.jpg

To ensure that local people from Southern Sudan could maintain the GIS, a one-month training program educated twenty-one representatives (sixteen men and five women) from the ten states that make up Southern Sudan. Most participants had not used computers before, so they studied basic word processing and database development before learning how to use the GIS.

The Strategic Participatory Town Planning Initiative culminated in a national urban planning conference in July 2007. National, regional, and local urban planners, along with development experts, participated in the event to coordinate efforts to establish a modern system of government and to better manage infrastructure development in the country.

The initiative has led to improved intergovernmental communication and greater land use and land management capacity among municipal staff. It also resulted in the introduction of a pilot land allocation process to assist with the reintegration of returning populations. Other efforts include a satellite communication system in each state, managed by the Ministry of Physical Infrastructure, and dedicated training in participatory urban planning to help officials ensure involvement of local populations in decisions regarding their communities.

Excerpted from "First Southern Sudan Urban Planning Conference Gathers Urban Planners, Development Experts and Private Sector," an article by the Ministry of Land, Housing and Public Utilities, Southern Sudan, accessed October 2008: http://mhlpu.org/newsroom/news.php

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Geospatial Information Technologies and Urban Management

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.

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GIS Strengthens Public Health Planning in Sub-Saharan Africa

AT ISSUE Worldwide over 42 million people are living with HIV/AIDS, and nearly 75 percent of these infected people live in sub-Saharan Africa. With HIV/AIDS at epidemic levels throughout Africa, health organizations struggle to determine appropriate treatment methods and intervention strategies for working with antiretroviral therapy (ART) patients. (ART therapy is a drug treatment program that suppresses or stops the replication of HIV and other retroviruses.)

Health care professionals need the ability to predict the geographic spread of disease, demonstrate temporal disease trends, analyze health service gaps, and design HIV prevention campaigns to stop the spread of the disease. With such information, better treatment and care can be provided to those living with HIV/AIDS, allowing them to live longer and healthier lives.

THE RESPONSE Family Health International (FHI) works with health organizations in many sub-Saharan African countries to prevent the spread of HIV and improve care among those at highest risk. FHI has used many methods to meet health care challenges throughout Africa. A recent initiative using geographic information system (GIS) technology uses different types of spatial data to improve strategic planning for HIV/AIDS programs in rural and urban areas.

FHI began mapping the location of health facilities by collecting global positioning system (GPS) points. Detailed information about the prevention, care, and treatment programs associated with each health facility was also recorded, as were pertinent data on ART patients in the area. This information was then combined with geographic information collected for the health care facilities and stored in a "geo-database."

A GIS application uses the GPS data and other information to create maps that show locations of patients relative to health care facilities. For Kenya, Rwanda, and Zambia, FHI has created national maps that show the geographic reach of their prevention, care, and treatment programs.

With this new tool, FHI staff are better able to analyze the quality and breadth of services provided in relationship to the needs of the population. GIS analysis has helped the organization make better decisions about resource allocation and service provision. Also, the maps generated from

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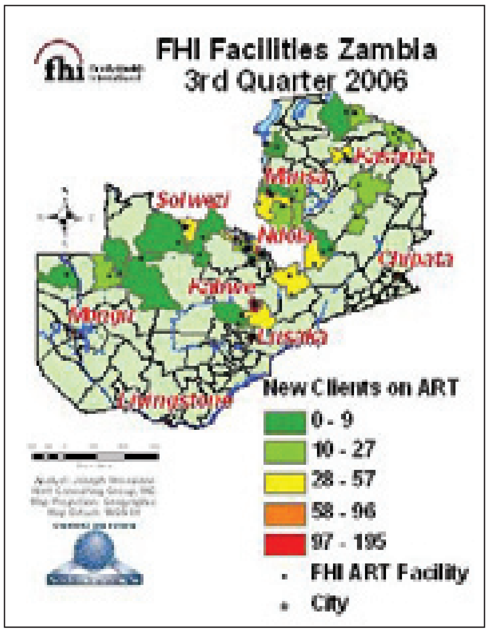

Source: www.fhi.org/en/CountryProfiles/Zambia/res_GIS.htm

the GIS have facilitated more effective communication with policymakers and funders about the need for different types of services in different places. Ultimately, however, the system helps FHI provide better health care and save lives throughout Africa.

Excerpted from "Geographic Information Systems Strengthen FHI Program Planning," by Mary Dallao, Family Health International, accessed October 2008 (search for HIV/AIDS publications, new pages first, search term "geographic information systems"): http://search.fhi.org/cgi-bin/MsmGo.exe?grab_id=92480164&extra_arg=&page_id=1515&host_id=1&query=GIS&hiword=GIS. Adapted with permission from Family Health International, Arlington, Va. Not for reproduction or distribution for commercial gain.

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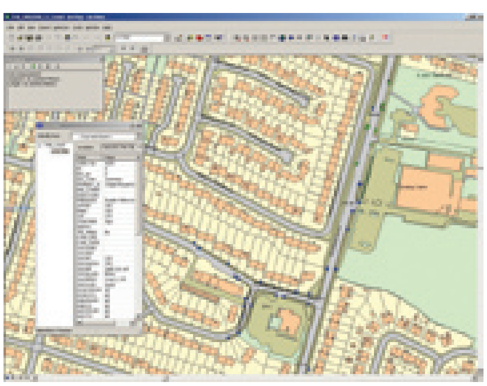
Geospatial Information Technologies and Urban Management

Newcastle, England, Monitors Traffic Using GIS

Urbanization is happening at an unprecedented rate in human history. Rapid urban growth is challenging the ability of cities around the world to deliver the services that residents need. Geospatial information technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing can help local governments better plan and manage urban issues.



Source: Chris Oman, Traffic and Project Management, Newcastle City
Screenshots of the GIS application in use, from GPS capture on street.

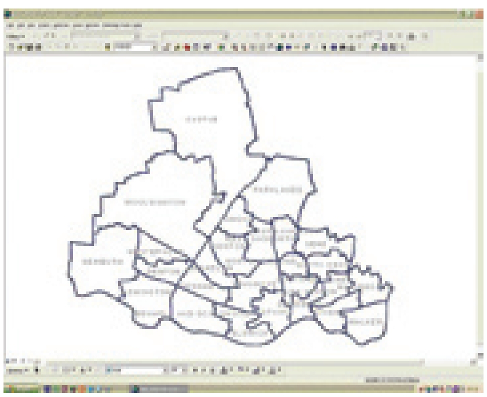
U.S. Agency for International Development
www.usaid.gov

AT ISSUE As a regional business hub, Newcastle has a population of more than 260,000 people with a substantial number of daily commuters. And like many urban areas, the city has its share of traffic issues. Speeding vehicles and subsequent accidents are a concern for city officials. As surveys reinforced the link between speed and accidents, the city council decided to implement a Speed Management Initiative. In addition, the British government passed a national Traffic Management Act 2004 (TMA), giving local authorities greater power to enforce traffic and parking offenses. The city council needed evidence of where and when speeding occurred before implementing an enforcement program.

THE RESPONSE Since vast amounts of spatial data would need to be collected, managed, and analyzed, the city council chose to use a geographic information system (GIS). The city was already using GIS in other ways, so the council opted to use it for better traffic management as part of the city's Speed Management Initiative.

Under this initiative the city collected data on traffic flow and speeding patterns. Newcastle employees installed over 100 traffic speed sensors across the city. Each sensor transmits data in real time over a mobile network to a central server. From there, the data are transferred to a dedicated speed management GIS application, where they are displayed on interactive city maps and aerial photographs. Speed sensors are represented on the maps as discrete color-coded icons. Sensors that detect high levels of speeding are shown as red circles. Sensors that detect only occasional, minor speeding are shown as yellow circles, and green indicates areas where no speeding is detected. Using the application, managers can examine actual average speeds along particular stretches of road or determine the proportion of motorists who exceed speed limits by more than 10 percent, more than 20 percent, or other parameters they want to monitor.

Under the related Traffic Management Act Initiative, which is designed to respond to requirements of the national TMA, Newcastle City Council found it needed to maintain up-to-date information about a wide range of traffic regulations posted on street signs and other markings. These included "no entry" signs, double yellow lines, designated handicapped parking, and parking meters. In order to successfully prosecute offenders of



Source: Chris Oman, Traffic and Project Management, Newcastle City

Screenshots of the GIS application in use, from GPS capture on street.

the traffic regulations, the council had to ensure that the actual signs and road markings corresponded correctly with the city's documentation of those signs and markings. To that end, the council employed two people to compare traffic regulations as communicated to the public in the real world with the regulations defined on paper.

Data were collected via mobile, hand-held devices that fed into a customized GIS application. Analysis of the information collected from field visits revealed discrepancies between traffic regulations and traffic signs that were actually in place on streets. For example, some traffic regulations on paper referred to roads that no longer existed in the real world. In other locations, yellow lines had been obscured during road repairs and had not been repainted. With an improved understanding of problem areas, the Newcastle City Council updated its street markings, street signs, and traffic regulations to ensure that they were all in sync with each other.

As a result of these two initiatives, the city council is in a stronger position to issue and defend fines for traffic offenses. For example, when parking offenses are appealed, the council can use its GIS application to view the specific section of the road under question to determine which restrictions apply and which signs or road markings exist. This ability allows the council to issue fines and investigate appeals more promptly. More importantly, the two initiatives working together have reduced speeding, traffic accidents, and personal injuries.

Excerpted from "Newcastle City Council Managing Speed and Traffic Restrictions with GIS," a paper by ESRI UK, December 7, 2006, accessed October 2008: http://www.gisuser.com/content/view/10397/28/