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## Using Geographic Information System (GIS) in a local government—a case study of GIS implementation in Ascension Parish Government, Louisiana

Hongwei Zhao

*Louisiana State University and Agricultural and Mechanical College*

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**USING GEOGRAPHIC INFORMATION SYSTEMS (GIS)  
IN A LOCAL GOVERNMENT  
---A CASE STUDY OF GIS IMPLEMENTATION  
IN ASCENSION PARISH GOVERNMENT, LOUISIANA**

**A Thesis  
Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agriculture and Mechanical College**

**In partial fulfillment of the  
Requirements for the degree of  
Master of Science  
in  
The School of Architecture**

**By  
Hongwei Zhao  
Bachelor of Architecture, Southeast University, Nanjing, P. R. China, 1994  
December 2002**

## **Dedication**

To my wife Min Lu. Without her love, kindness, and patience, it is impossible for me to finish this work.

## **Acknowledgments**

My first acknowledgment is to my advisor, Dr. Michael Desmond. His guidance played a crucial role in the completion of this work. I will always remember my graduate studies under Dr. Barrett Kennedy's supervision and special thanks to Mr. Christopher C. Theis. I would like to thank Mr. Farrell Jones for his support in my study in LSU and works in Ascension Parish

I would like to thank Mr. Randy Osborne for his help both in my student work in Ascension Parish and my study work. Also I will thank Kib Prestridge and P. J. Peterson for our happy times in Ascension Parish GIS Department. Special thanks for Lance Brock, Lisa Gautreaux, and Martha Collins. Also I will remember Shu Zhang, Canxia Qin, Dayong Huang, and Blain Lee.

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## **Abstract**

The objective of this paper is to argue for a new model of Geographic Information System (GIS) implementation, Web-based GIS, for supporting decision-making in local government. In this paper, the GIS implementation in Ascension Parish Government, Louisiana is used as a case study to show how Web-based GIS implementation can improve the system use and maximize the value of GIS infrastructures for the community. The author first defines the concept of implementation and role of GIS in local government as a base for further discussion. Special attention is given to analyze the variables that influence the parish employees' acceptance and use of the GIS in the work. A three-level evaluation framework is established to evaluate GIS implementation strategy and GIS impacts on decision-making in local government. Research findings will be used to direct future implementation strategy. The paper concludes that Web-based GIS, by combining GIS technology and Internet technology, can distribute GIS resources and geo-processing tools to a wider range of potential users. In addition, flexible user-oriented GIS applications can best be developed with intensive user participation and feedback. One of the arguments proposed is that the Web-based GIS can be used to help the local government employees to provide better service for the public and improve the performance of a specific local government agency in processing land development permit applications.



## Chapter 1. Introduction

This is a study of the implementation of Geographic Information System (GIS) in local government. GIS project in Ascension Parish Government, Louisiana, has been used as a case study for examining GIS implementation strategy. During the research, the author has identified a major problem associated with the parish GIS project is the under-utilization of GIS infrastructure and geographic data resources by local government employees. It is the author's belief that this problem is stemmed from current GIS implementation. First, current GIS implementation cannot provide access to geographic data to a broader range of potential GIS users. Lack of data access prevents local government employees from getting benefits from GIS. Second, current GIS implementation cannot provide flexible user-oriented services to meet local government employees' needs in their work. Third, due to lack of sufficient training and knowledge, most local government employees still think it is difficult to use a specific GIS package. All these situations combined lead to a low level of GIS usage in Ascension Parish Government.

The author is motivated by these situations to reconsider the GIS implementation strategy and propose a new model<sup>1</sup> of GIS implementation, Web-based GIS, in Ascension Parish Government. The thesis will show why and how Web-based GIS can overcome the shortcomings in current GIS implementation and improve the utility of the GIS technology in local government.

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<sup>1</sup> The term *model* used here refers to an information system.

## **Concept of Implementation**

Before further discussion, it is necessary to clarify what the concept of implementation is. Obermeyer and Pinto define the concept of “implementation” in the context of organizations as a change phenomenon or a process for creating organizational change. Further, they view the problem of implementation as the frequent failure to create some degree of desired organizational change through the introduction of a new information system, program, or model (Obermeyer et. al 1994). Lucas, Ginsburg, and Schultz define “implementation success” in terms of changed behavior of the organization or part of the organizational members (Lucas et. al 1990)<sup>2</sup>. From these definitions, one can see that organizational change is the key issue to be monitored when studying the implementation of an information system in an organization. Given this attitude, GIS implementation is defined as the change that takes place in the staff members’ decision-making behavior and organizational structure in the local government by introducing the GIS technology.

## **Role of GIS**

Creation and maintenance a GIS is a costly endeavor. Many decisions have to be made regarding both technical and administrative issues. More important for a GIS planner, is to make the decision regarding the role of the GIS and how it will impact the organization. Local government usually spends a lot of money in hardware and software, data conversion, and additional technical staff. The policy maker expects to see benefits from GIS to justify its costs. Researches have been done on examining the implementation of GIS with benefit-cost analysis.

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<sup>2</sup> See Lucas et. al. “Information System Implementation --- testing a structural model,” p24-26

Unfortunately, conventional benefit-cost analysis has the following shortcomings: first, compared with its significant cost, the benefits from GIS are difficult to measure. According to a study in Palo Alto, California, the researcher suggests that in its first three years installation, no evidence shows for direct cost savings from GIS.<sup>3</sup> On the other hand, indirect savings in promoting convenience, efficiency and equity with GIS are difficult to measure. Second, those studies, according to Nedovic-Budic's research, that "focus on financial aspects of the GIS implementation are inadequate to offer an understanding of what planners need and want from the new tool, what they get from it, and how they are impacted by it." In addition, those studies do little to "change the GIS acquisition and implementation decision made by government agencies." She even suggests "the question more fundamental than what to measure is whether or not to measure it at all," "for government agency perceived the GIS capability and functionality as beneficial and crucial for competent and well-managed government." "Keeping pace with technology" is an important goal to pursue (Budic 1998)<sup>4</sup>.

Thus, if the financial aspect of the GIS impact is difficult to measure, then what factors should be measured to examine the implementation of GIS? To answer this question, it is necessary to clarify the role of GIS in the organization. Although GIS is said to be a useful tool for supporting decision-making, this commitment can be backed only when the data provided by GIS are used by the decision maker. Given this attitude, the study then focuses on studying factors that can improve the use of GIS to direct the implementation strategy. Researches on implementation of information system, especially the Operations Research/Management Science

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<sup>3</sup> O'Looney, John "Beyond Maps --- GIS and Decision making in local government" p 10

<sup>4</sup> Nedovic-Budic, "implementation of GIS" *Environment & Planning B: Planning and Design* 25 p681

(OR/MS) model, provide a useful starting point in designing this study.<sup>5</sup> Those researches, instead of focusing on technical issues and their impacts, are more concerning the variables that influence the user's acceptance and utility of the information system. Henry C. Lucas Jr. provides a descriptive model of the use of an information system. In this model, there are four classes of independent variables in terms of quality of system, attitude and perception, decision style, and situation and personal factors that affect the system use. He suggests that attitude and perception of the user, as well as the decision style are two strongest variables directly affecting the use of the system<sup>6</sup>. Based on these researches, a survey and a series of interviews are conducted by the author to identify the factors that affect the utility of GIS technology in Ascension Parish Government. Designing of the survey and interviews as well as the analysis of the results will be introduced in Chapter 5.

### **Web-based GIS Implementation**

A new model of GIS implementation, Web-based GIS, is introduced in Chapter 6. Compared with the current GIS implementation in Ascension Parish Government, Web-based GIS has the following advantages. First, Web-based GIS, by combining the GIS technology and the Internet, can provide an almost unlimited data access to GIS user. Second, Web-based GIS can provide flexible GIS services to the user. The user can request GIS services and get response through Web-based GIS at any time and possibly at any place. Third, Web-based GIS is easily to use and low cost. Web-based GIS does not require the user to get trained to use it. Any one who knows

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<sup>5</sup> See Schultz et. al "Implementing operations research/management science" American Elsevier Publishing Company, Inc. New York 1975, p3-4

<sup>6</sup> See Schultz et. al "Implementing operations research/management science" American Elsevier Publishing Company, Inc. New York 1975, p202

how to use the Internet can use Web-based GIS. On the other hand, by immigrating parts of the basic function of a GIS to its applications, Web-based GIS enables the users who do not have a GIS program to perform some powerful GIS functions.

In summary, Web-based GIS can distribute GIS data and geo-processing tools to a broader range of potential users that conventional GIS implementation may never reach. Using Web-based GIS can improve the utility of GIS technology and GIS data to support decision-making in local government. In Chapter 6, Web-based GIS implementation strategy is introduced. An application of using Web-based GIS in Planning Department of Ascension Parish Government is presented in Chapter 7.

### **Evaluation Framework of GIS Implementation**

Another goal of this thesis is to evaluate GIS implementation strategy in local government. It is the author's hypothesis that the success of GIS implementation is determined by how well the GIS technology changes the decision-making behavior in the local government. Positive change brought by GIS into the local government can take place only when GIS technology gets widespread acceptance and utility among the staff members. Based on Lucas's descriptive model, a three-level evaluation framework is proposed in the context of information process in local government. In this framework, three levels of change are examined. The first is on the level of parish employees. The study will explore the factors that influence employee's acceptance and use of GIS in their work and how GIS implementation changes the operational decision-making of the parish employees. The second is on the level of small group, or the parish department. The study will examine manager's decision style, group norm, and their impacts on GIS use. The study will also evaluate the changes on managerial control brought by GIS

implementation. The third is on the level of organizational structure. The study will examine the existing data flow pattern of the local government and how GIS implementation affects the data flow and what changes it brings to the information process in local government.

Throughout this thesis, current GIS implementation and proposed Web-based GIS implementation in Ascension Parish Government GIS project are evaluated with this three-level framework. The author hopes that this framework can help the GIS planners to identify the problems in GIS implementation strategy and avoid repeating these problems in their future effort.

## **Study Methodology**

A case study method is used during the research. The study began with an on-line survey<sup>7</sup> conducted in Ascension Parish Government. A series of interviews were held with GIS developing team and department managers. Additional data included GIS task reports, letters, minutes and agenda. This method allows the author to collect a broad range of data in some depth.

## **Organization**

The thesis introduces the background of the GIS project in Ascension Parish Government in Chapter 2. Chapter 3 reviews the current status of GIS implementation. Following in Chapter 4 is a case study of using GIS in redistricting the Parish Council District boundary. Chapter 5 is the analysis of the results of the survey and interviews conducted by the author. Chapter 6 reviews

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<sup>7</sup> On-line survey is available on ([http://ascension.par.la.gov/dev/under\\_construction/gis/gis\\_survey.asp](http://ascension.par.la.gov/dev/under_construction/gis/gis_survey.asp))

the development history of GIS technology and impacts of the Internet and World Wide Web (WWW) technology on it. Concept of Web-based GIS implementation is introduced. Chapter 7 is a report of a concept design of Web-based GIS application in urban land use plan in Planning Department of the Ascension Parish Government. The paper concludes that the success of GIS implementation in local government depends on how well GIS is integrated into the information process and what changes it brings to the decision-making. Only when GIS obtains widespread acceptance and utility in the organization, can its value be maximized. For GIS planner, carefully monitoring of the changes brought by GIS is important to direct future designing of the GIS application. Design is an iterative, participating process. Frequent user's feedback is important for designing flexible and responsive GIS applications that can meet the user's needs effectively.

## **Chapter 2. Background**

Ascension Parish, Louisiana is located on the Mississippi River just below the State Capital, Baton Rouge. The land area is 192,000 acres and ranked 58th among Louisiana's 64 parishes. The population is 76,627 according to 2000 U.S. Census. Despite its small size, Ascension Parish is one of the fastest growing parishes in the state. In recent years, the parish has experienced an accelerated economic and population growth, especially in the northern part of the parish. Except for a four-year period from 1987-1990, the parish's population has steadily grown at rates significantly higher than the state average. Two factors contribute to this strong population growth. First is the rapid growing job opportunity in the parish. Over 1969-1999, employment in Louisiana rose by 65 percent, Ascension Parish employment grows by 217 percent over the same period. Second, the urban-to-suburban shift benefits the Parish's population growth. Families have been moving from urban population centers, such as Baton Rouge, to the bedroom communities, Ascension Parish.<sup>8</sup>

In this fast growing trend, careful management of land use plan is crucial to the taxpayer of the parish. The purpose of the plan is to protect both the private property value and public goods. The land use plan is a component of the master plan for the parish. The most recent master plan was completed in 1997 for a time period of 1998-2002. The land use plan was completed in 1997 and is to be revised every two years. Based on the land use plan, the parish council adopts the zoning ordinance, cited as Ascension Parish Development Ordinance, and the Ascension Parish Subdivision Regulation. Several planning issues have been identified in the land use planning process. First is the conflict between public

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<sup>8</sup> See Scott, Loren C. Ascension: Portrait of a prosperous parish p17



safety and the petrochemical industry. The latter is the main industry that generates the economic growth for the parish. Second, the land use plan and the zoning ordinance based on the plan will protect the property value of the landowners. Third is the need to carefully plan the future land use pattern to make public infrastructures to be used efficiently, whereas within an unplanned sprawl, the cost for road, water system, school and public service will soon result in large tax increase. In addition, the parish residences favor the rural characteristics of the parish and want the plan to keep a balance between urban development and rural characteristics preservation. In 1997, the parish government decided to adopt a GIS to manage the land use information in the Parish Government Office. As most of the jobs in the local government are related to geographic data, the government officials hope GIS implementation can improve the productivity and enhance the performance of the government employees. Probably the following statement in the Ascension Parish Master Plan 1998~2002, adopted by parish council in February 1998, explicitly defines the objective of the parish GIS project. It said that the GIS would “provide flexible and responsive support for making decisions,” and “provide accurate and timely answers to critical questions concerning how land use is changing. It will provide information needed to analyze the social, economic, fiscal and environmental impact of these changes. In addition, the GIS will be able to compare these changes to historical trends and future projections.”<sup>9</sup>

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<sup>9</sup> The focus of this study is limited to using GIS to manage spatial information. GIS usage in spatial analysis and future projection is an on-going effort for the parish GIS project.

## **Chapter 3. Review Current GIS Efforts**

### **Introduction**

In August 2000, I joined the GIS Department of Ascension Parish Government as part of the contract between the parish government and Louisiana State University (LSU) to help the staffs of the GIS Department implement the parish GIS project. At the time, the GIS Department experienced a significant change in its membership. In several months, three key staff members, Bill Wiespape, chief GIS technician, Craig Johnson, department manager, and Amanda Becot, network specialist, left their positions. Rumors already existed that the GIS Department would be dismantled and merged into Department of Public Work. The situation could not be worse for the GIS Department. It was just the third year since its initial establishment in 1997. The staff had already converted a large volume of data into the GIS database. Map produce service had already begun for the parish government employees and the public even since the first year's running of the system. Then, what problems made the parish government to consider giving up its GIS project? To understand this question, a brief review of the GIS program in the parish is necessary.

### **Findings and Interpretation**

It was in 1995 that the Parish President Tommy Martinez directed the establishment of the GIS unit in the parish government. In June 1996, a GIS task force was appointed to direct the activities of the GIS unit. The members of the GIS task force were from five parish departments, including Office of Parish President, Department of Planning and Development, Office of Assessor, Office of Emergency Preparedness, and Department of Public Work. The five departments were willing to provide financial

support for establishing the GIS unit. The following events were highlighted to display the initial efforts of the GIS unit:

- **Craig Johnson as GIS coordinator.** The GIS task force hired Craig Johnson as GIS coordinator in June 1997. Before came to Ascension, Mr. Johnson had ten years experience of federal, state, and parish GIS projects.
- **Statewide GIS use survey.** In July 1997, Mr. Craig conducted a statewide survey titled as “Responding to Requests For GIS Data”. Totally 24 parish GIS were sent the questionnaire and the GIS units received 11 responses. The main issues concerned in the survey included: type of products from current GIS, methods for collecting fees for GIS products, public access, liability and copyright of GIS data.
- **Initial effort in data collection to establish base map for the parish GIS.** Before establishing the GIS unit, parish geographic information was independently maintained by several parish departments. By June 1997, Office of Assessor, by contracted with Ray & Associated, had line files of the parcel maps of the parish in AutoCAD’s .DWG format. Department of Planning and Development had a MapInfo package for generating map and a permit database, developed with Lotus Approach, for tracing and maintaining the permit information and municipal addresses. Department of Public Work had its geographic information maintaining in an IBM AS/400 system. In February 1997, the Office of the Parish President entered into an inter-agency agreement with the Office of the Assessor to acquire parcel base-map in exchange for access to the GIS network.

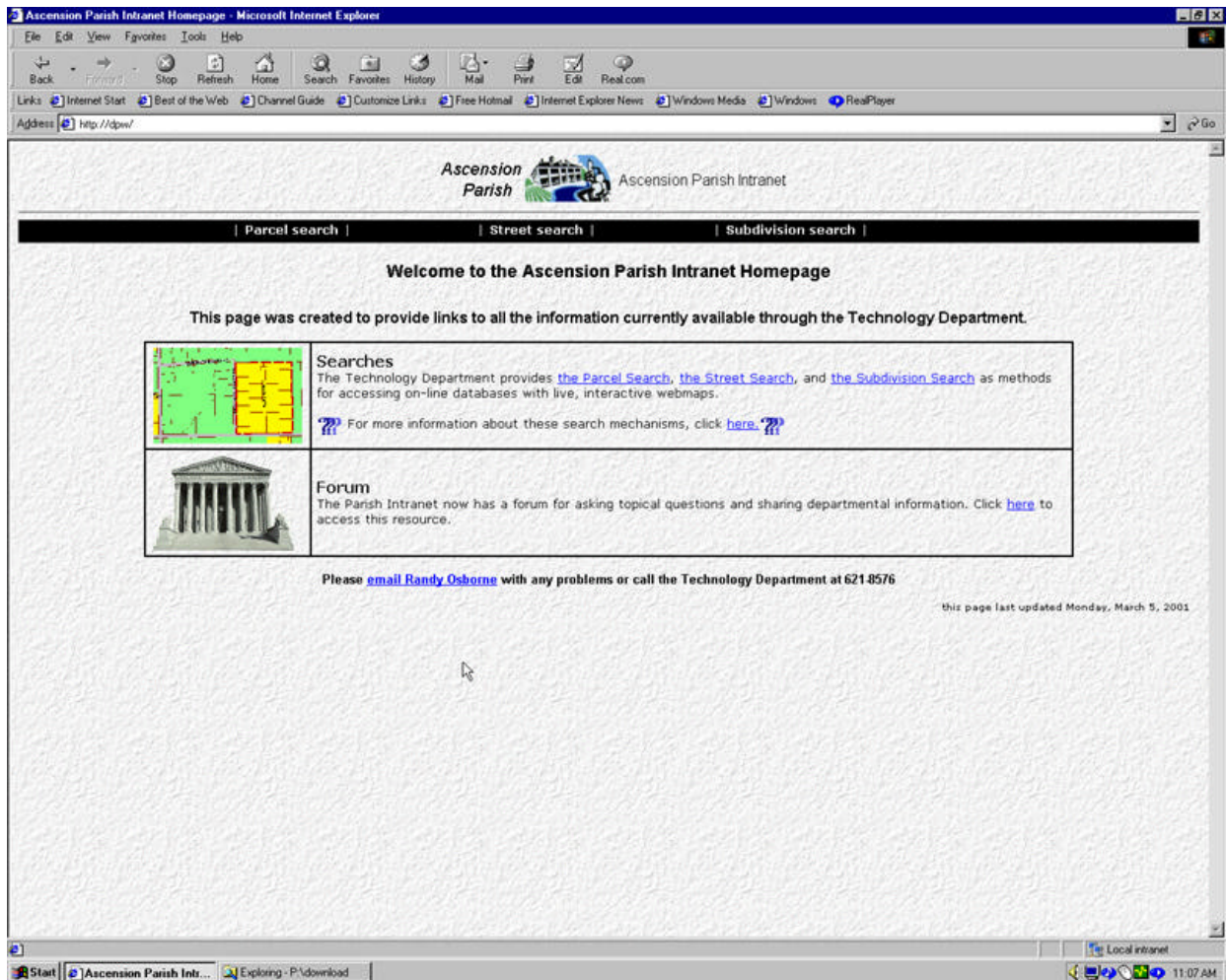
- **Contract with LSU to get technical support.** In January 1997, the parish contracted with Farrell Jones, CADGIS lab of LSU, and Dr. John Pine, Institute of Environmental Studies of LSU to assist in the preparation and maintenance of GIS layers as well as consulting on implementation and technical support and providing user training.
- **Hardware and Software installation.** In April 3, 1997, a bid was held in parish government for hardware and software used in GIS unit. In July 1997, the GIS unit finished the installation of the hardware and software. Ray & Associates were required to add coordinates for the parcel maps. The final parcel map was rectified with 1' resolution aerial photograph as the backdrop. In the mean time, the parish contracted with Gulf Engineer Company (GEC) for creating a new layer of street centerline for all parish roads to connect the digitized municipal addresses.

In June 1998, Angelle Graves was asked to evaluate the one-year activities of GIS unit. In her report, Ms. Graves had identified three main problems of the parish GIS project. First is “the GIS project lacks a plan with a comprehensive set of objectives targets at community benefits...” In addition, “no standard process for reporting project status” as well as benefit-cost analysis has lead to “a loosely defined vendor agreement and unenforceable service levels with subcontractor.” Second, the GIS project efforts “have been governed by ‘squeaky wheel’ prioritization”, and lack “formal management processes”, the activities of the GIS unit is driven by the individual requests, and it has led to “an insufficient use of valuable GIS resource”. Third, “minimal on-going communication throughout parish department, government agencies, and local industry has led to limited understanding of GIS capabilities....” For future GIS implementation, Ms. Graves proposed the following recommendations:

define strategic and operational objectives and develop comprehensive, detailed plans targeted at achieving specific goals; establish management processes governed by a formal committee to direct GIS strategic activities, define status reporting to support interim communication; identify processes within the government that would benefit from GIS and (re)engineer operations to improve efficiency using GIS technology; conduct an education campaign on GIS both within and outside parish government entities. For the first problem, Mr. Craig Johnson disagreed with Ms. Graves that GIS unit “lacks of a comprehensive set of objectives.” He claimed that the GIS unit did have a comprehensive plan since the inception. During the first year efforts of the GIS unit, the main task was to construct data layers for future custom services. Whether or not fulfill the long-term goals of the GIS project was difficult to evaluate in the beginning phase of the GIS project. Mr. Johnson disagreed that addressing individual request would lead to insufficient use of GIS resources. He mentioned “over 300 maps were created by GIS unit for the parish,” the benefits was obvious if “those maps had been produced by an engineering firm for the parish, the parish would have paid considerably more.” He believed that map production was the main source of benefits to justify the cost of GIS. For the third problem, he agreed with Ms. Graves that the GIS unit needed more communication with other departments to show the potential capability of the GIS and bring more custom services.

Besides map produce as primary GIS service, Mr. Johnson also made efforts to develop GIS website on the parish network. In September 1999, the parish contracted Dallas-based consulting firm the Applied Technological Services (ATS) Inc. to develop a browser-based GIS searching tool for querying parcel information. In addition to the parcel search tool, two LSU graduate students developed

street search and subdivision search tools in June 2000 for the parish GIS unit. These GIS searching tools facilitated the parish employees to obtain information for their



(Figure 1. Starting web page of parish Intranet GIS searching tool for parcel search, subdivision search, and street search)

needs. For example, the following information of a parcel can be obtained with the parcel search tool: tax ID, owner's name, area, zoning information and parcel map. In June 2000, ATS modified its parcel search tool and added the aerial photograph as the backdrop of the searching result.



Mr. Craig Johnson left the GIS Department in Aug. 2000. Randy Osborne was hired as his successor. By examining previous GIS effort, Mr. Osborne identified the challenge to parish GIS project was to diffuse the GIS technology to a broad range of areas across the parish government to maximize the value of the GIS resources. He believed that the opportunity for diffusion of GIS was the combination of GIS technology and World Wide Web (WWW) technology. In an interview with him, Mr. Osborne outlined his plan for the future development. The first need was to gain support from the parish policy maker. A pilot project was suitable for demonstrating the potential of the new GIS model. Then the GIS Department used this pilot project to convince other department managers to get their support and proposed specific applications for their needs. The long-term goal was to integrate the stand-alone information systems in the parish with the Web-based GIS and create a mandatory GIS environment for government employees.

Under the direction of Randy Osborne, the GIS Department shifted their major efforts to Web-based GIS tools development. In June 2001, a pilot project, Ascension Web-Map, was initially installed. The concept of the Web-Map was from the browser-based GIS searching tools, but more geographic features were included. Running on the new web server of the GIS Department, the parish Web-Map was accessible to any computer that had an Internet connection. In the mean time, a GIS training lab was established in the GIS Department, training session on GIS program were scheduled and provided to all parish employees.

### **Implication**

Reviewing the GIS efforts in the parish, I conclude that current GIS implementation does not satisfy the objective of the parish government as mentioned in the parish master plan. A major problem is that



the parish employees significantly under-utilized the GIS infrastructures. Although the GIS Department maintains a large volume of GIS data, access is inconvenient for most of the parish employees due to its current implementation. For example, when a parish employee has a need for querying spatial data, he/she needs to submit a map request form to the GIS Department and waited for 2-3 days for responses. The employee can also query the information through the GIS searching tool on the parish local area network, but only a limited category of geographic features are available.

On the other hand, current GIS implementation is not efficient for data exchange between the parish departments. Until now, the GIS database is still not shared among parish departments. As an alternative solution, the GIS Department installs GIS program and copies of its database in some departments. In case the database needs update, the GIS Department has to make a new copy for those departments. When those departments need update their own information, they have to hand in the data to the GIS Department to update the databases both in their departments and the GIS Department. Finally, parish employee's low involvement of the GIS effort with their daily operation directly affects their knowledge of GIS potential. The parish GIS is still not integrated into the information process in the parish government. Providing support for decision-making has no way to realize with current implementation. If the decision-maker does not intensively use the information provided by GIS, the value of the GIS for an organization is limited and the implementation can hardly be assumed as success. This situation requires the GIS planner to reconsider the objectives of implementation. For example, in evaluating the parish GIS project, the real difference between Mr. Johnson and Ms. Grave is the different perspective of the GIS implementation. In Mr. Johnson's

standing point, the success of GIS implementation is indicated with a directly benefits-cost analysis. This perception makes him consider the map produce as the primary function of the GIS. On the contrary, Ms. Graves addresses the long-term goal of the GIS as to “maximize the technology use in the parish government.” As I mention in Chapter 1, to evaluate whether an implementation is successful or not, one needs to monitor the changes that occur in the organization when the new information system is introduced. Otherwise, the GIS planner has to explore efficient implementation strategy to trigger the changes to the decision-making process with GIS.

In the next chapter, a case study of GIS usage in redistributing Parish Council District boundaries is introduced. The author tries to use this case as an example to make further discussion on examining the problems of the current GIS implementation.

## **Chapter 4. GIS Usage in Redistributing Parish Council Districts**

### **Introduction**

In this chapter, an example of using GIS technology in redistributing Parish Council Districts boundaries in Ascension Parish is introduced. The role of GIS and how it affected the decision making process for this political issue are presented and evaluated with the framework introduced in Chapter 1. In this case, most of GIS efforts are made by an outside consulting firm for the parish government, instead of by parish GIS Department. The author tries to show that local government, even without adopting a GIS program, can also obtain GIS service from private company for its specific objective. In this situation, GIS technology is merely another technical improvement (no more than a new type duplicate machine). It is hardly to see any organizational change brought by GIS to the local government in the perspective of implementation. On the other hand, this case indicates that it is a limited way for the local government to get benefits from its GIS project if its efforts are just focused on using GIS technology in these random projects.

### **Background**

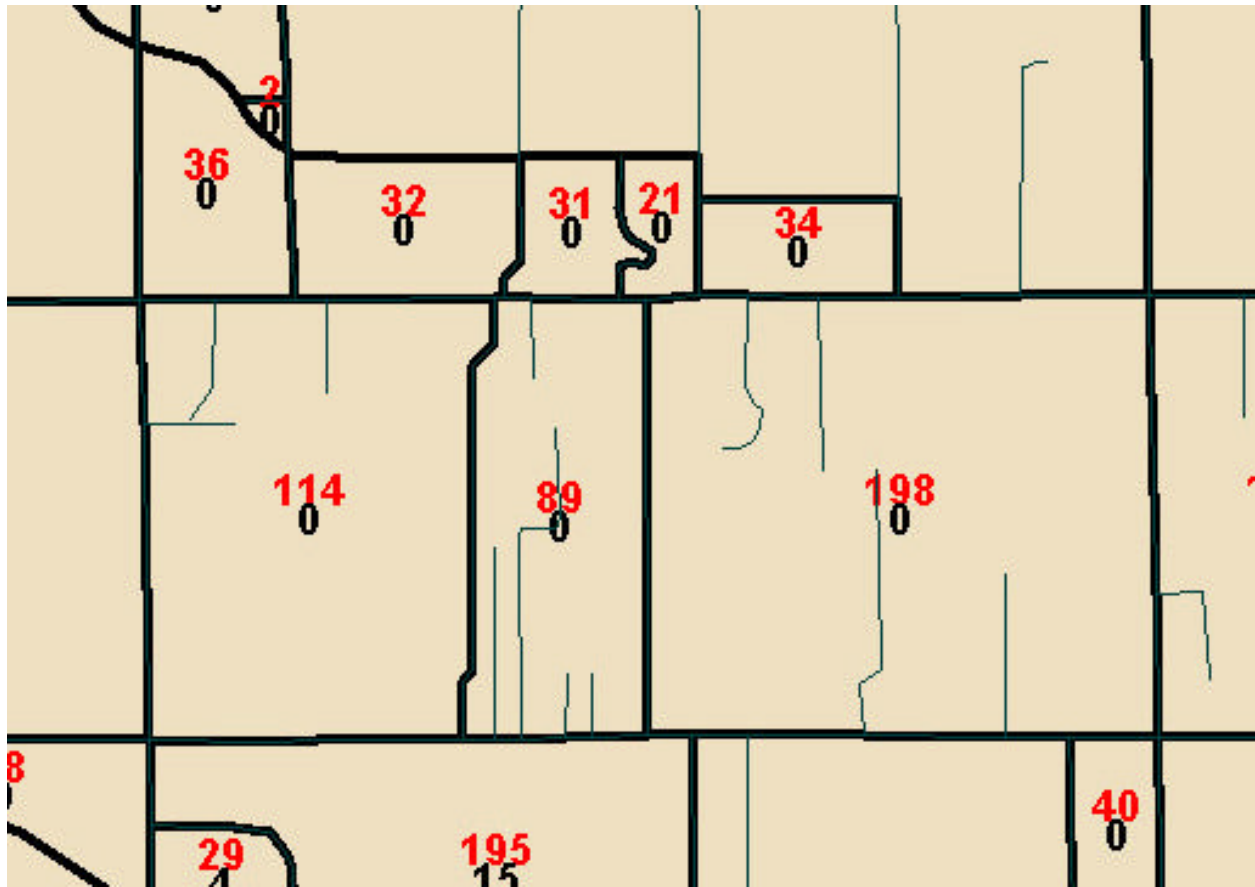
In November 2001, Ascension Parish Council began to redefine the boundaries of Parish Council Districts. The current council district plan was adopted in 1991. After ten years of change in population distribution and the finishing of the 2000 U.S. Census, the Parish Council believed that the old council districts plan was not properly representational for future elections. The new plan would be used from January 1, 2004. The Parish Council held the principle for the new plan that distribution of race would play an important role in determining the future council district boundaries. According to 2000 Census

data, population of African Americans was 20.3 percent of the whole parish population. This situation should be reflected in the new plan that African Americans should be majority in two of the total eleven council districts. The Parish Council decided to use GIS technology in generating proposals for the new council district. They hoped this new technology could bring efficiency and scientific factors into the planning process. A consulting company, Campaign & Opinion Research Analyst, Inc. (CORA) was contracted to create new planning proposals for redefining the boundaries of Parish Council districts. Products of CORA will include both maps of the new plan and written description of the boundaries for each council district. Then the members of the Parish Council can vote on these proposals to determine the final plan for the Parish Council Districts.

## **Methodology**

The staffs of CORA use Arc View GIS package to generate the maps for the new plan. TIGER/Line files and 2000 Census data, provided by U.S. Census Bureau, are used as input data for the GIS system. The TIGER/Line file is a digital database of geographic features, such as roads, railroads, rivers, lakes, political boundaries and Census statistical boundaries, covering the entire United States. Those features are used to delimit the boundary of the Census block, which is used by U.S. Census Bureau as the unit for organizing Census data. The TIGER/Line files do not maintain those features in graphic image format. Information of those features, such as location in latitude and longitude, names, types of the features, address ranges of the streets, and topological relationship between the features, are stored in ASCII text format in the database. User can convert the information with a GIS program package to locate and display the geographic features of the real world into the maps. The

figure below displays a Census blocks map in Ascension Parish generated with a GIS program by using the TIGER/Line file.



(Figure 4. Example map shows a combination of Census block boundary with Census data. The red number indicates the population of White, and black number indicates the population of Black.)

A Census block is the unit that used by U.S. Census Bureau to organize the 2000 Census data. It is a small statistical area that is bounded on all sides by visible features such as streets, streams, and railroad tracts, or by invisible boundaries such as city, town, township, county limits, and short imaginary extensions of streets and roads. In TIGER/Line files, each Census block is associated with a unique 15-digit number key field named as 'STFID'. The first 2-digits stand for the state code, the next 3-digits

stand for county or county equivalent, the next 6-digits are Census tract number, and the last 4-digits are Census block number. For example, in number '220050300303002', '22' is the state code of Louisiana, '005' stands for Ascension Parish, '030030' is the Census tract number, and '3002' is the number of one Census block within that Census tract. In this way, each Census block is assigned a unique ID.

The TIGER/Line files describe the topological information of the Census block, but they do not contain demographic data of the Census blocks. The U.S. Census Bureau provides 2000 Census data for each Census block in both tabular form and ASCII text format in its website for free download. For Census data stored in tabular form, 'STFID' is used as identification number for records of each Census block. It is the same as the 'STFID' in the TIGER/Line files for the Census block. With a GIS program package, planner can associate the Census block map with Census data with this unique key field. The Census data then become attribute fields of the Census block. The planner can use Census blocks as 'bricks' to form large geographic area (in this case, the council district) with the polygon processing functions of the GIS. The Planner can generate different plans of council districts by changing aggregation pattern of the Census blocks or changing council district boundaries along the Census block boundary (see Figure 5 and Figure 6 for examples of grouping Census blocks to create temporary plan of future Council District map within a GIS). Cumulative demographic data for the council districts can be interactively displayed in the map and examined by the planner to follow the principle of the Parish Council. Once the map finished, the planner can make the description of each council district by tracing the boundaries of the council district in the map.



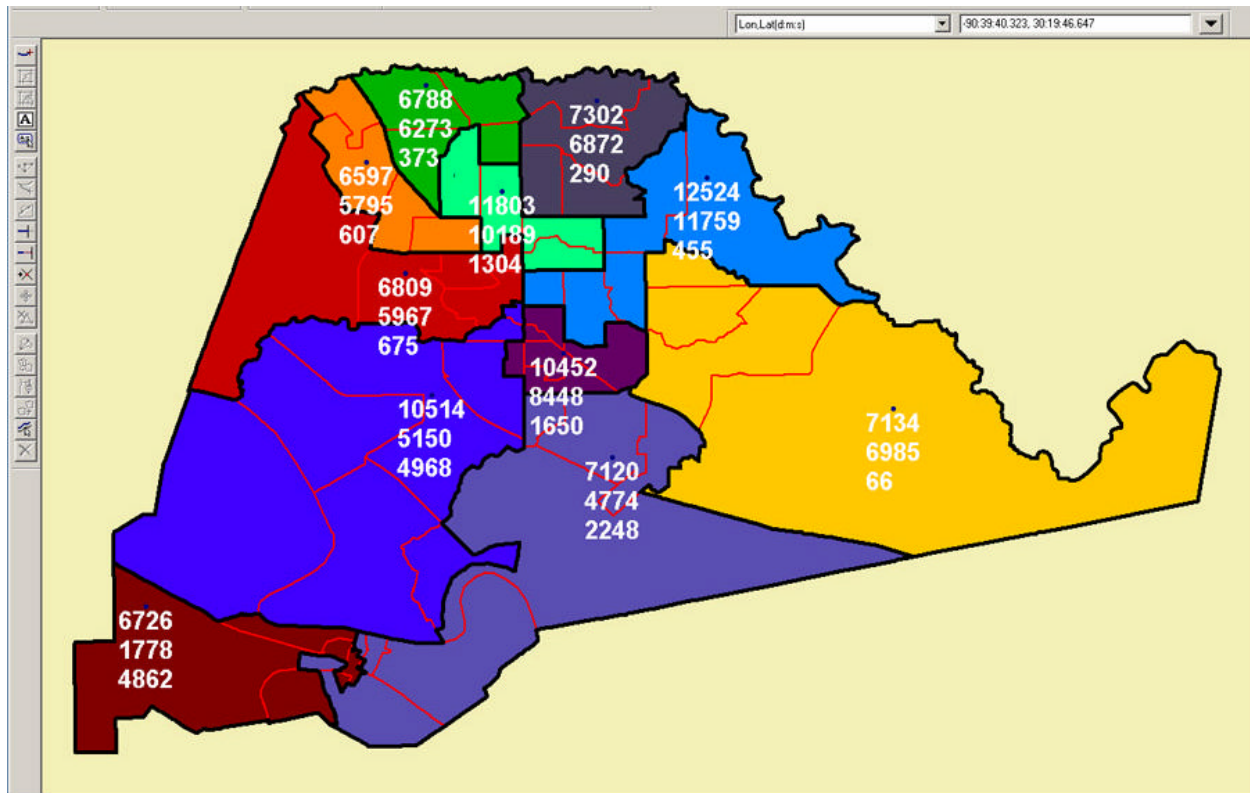
## **Finding and Interpretation**

In November 2001, CORA submitted the first plan of new council districts to the Parish Council. In the council meeting, the Parish Council members rejected the plan and asked CORA to generate two more alternatives for evaluation. In two weeks, CORA submitted all three plans to the council and the second plan was voted as the final plan to be adopted. In the mean time, two floppy disks that contained the maps of the plan and written description were submitted to the parish GIS Department for updating the council district map. During the map making process, staffs of the GIS Department found several discrepancies between the voted map and its written description. Then which one should be used as the correct information?

On the day when CORA presented its second and third plan to the council, council members made the final decision by voting on the map instead of written descriptions of the new council district boundaries. However, the written description is what becomes the legal document for establishing districts, not the map. After the final plan was selected, two Parish Council members reached the agreement to change the boundaries between the council districts they represented without informing other council members. CORA generated written description following this changed plan and this led to the discrepancy. This situation eventually caused the GIS staff to bring this discrepancy to the attention of the parish lawyer. The parish lawyer responded that legally any changes to the voted plan should be written as an amendment to the original planning document. Then the original planning document and amendment should be submitted together to the Department of Justice for permitting. Otherwise, the change may not be considered legal. The result was that CORA had to regenerate its written description



to match the map that was voted in the council meeting, together with an amendment added to specify the modification to the final plan. The final proposed Parish Council District map is posted on the parish website (see <http://www.ascensionparish.net> ).



(Figure 7. Map shows a proposed plan for Ascension Parish Council District, white numbers for each council district are total population, population of white, and population of Black from top to bottom respectively.)

## Implication

It was the first time that the GIS technology was used in redistributing Parish Council Districts in Ascension Parish. Documenting this event is important for others understanding GIS impact on the

decision making process. The parish GIS Department did not play an important role in this case.

Instead, an outside consultant company conducted most of job that involving GIS utility and the GIS Department was mainly responsible for checking data accuracy and updating the council district data in the GIS database.

Council district redistributing is a political issue. The decision-maker for political issues usually cannot fully follow a rational method as people thought. The stakeholders are affected by many factors to make their decision. On the other hand, when dealing with sensitive issues, like minority representative, using a GIS is suitable for creating equity in decision making. First, the GIS is efficient to integrate multi-sources of information with geographic features to create a comprehensive database for policy maker. For example, in determining the council district boundary, it was not as simple as a planner just moved the boundary then calculated the number of the people falling into the new boundary. Other factors, such as voting ward boundaries and convenience for people to go to the voting place, need carefully consideration. If the public schools are selected as voting places, school district map is helpful for the planner. By overlay that information within a GIS, alternative plans can be evaluated to help the decision-maker making choice. Second, the graphic map display of the plan and associated information are more effective than other means, such as tabular form, for presenting key issues for consideration. An important issue for using GIS in these cases is the data accuracy. Wrong information will mislead the data user. In this case, the GIS Department by double-checking CORA's plan prevented the discrepancy between the map and written description as well as the possible legal issue in the future.

When examining the GIS effort in this case within the evaluation framework, it is hardly to see any organizational change brought by introducing GIS into this process, at least the change was limited. On the first level, the parish employees did not involve the decision making process because most of GIS job were made by outside consulting company. On the second level, or the parish department level, it was the same situation as on the first level. From the viewpoint of the organizational structure, or the third level, there may be a limited change for the decision-makers in the parish government. In this event, they can have a good understanding of the potential of GIS for supporting their job. It may encourage them to use GIS in more cases that before they may never think about to use it. Once they see the benefits from GIS and pay more attention to the information provided by GIS, more rationality may be brought into the policy making to avoid bad decision.

On the other hand, this case shows that local government, even without adopting a GIS program, is still able to obtain GIS services for its specific objective. If GIS efforts are focused on these random projects, such as redistributing Council District boundaries (almost a ten-year period project), it is not necessary for local government to adopt a GIS program. For local government who seeking benefits from its GIS project, it should pay more attention to improving utility of GIS technology in the daily operation of its staff members. The strategy of GIS implementation should focus on the first level of change, in other words, making GIS as a must-use tool for more people in the organization. Only in this way, GIS technology can gradually integrate into the decision-making process and further affect the organizational structure of the local government.

## **Chapter 5. Study Design**

### **Introduction**

The objective of this study is to collect the data for evaluating the current status of GIS implementation in Ascension Parish Government. Based on the three-level evaluation framework for GIS implementation, two levels of change brought by GIS technology in Ascension Parish Government are monitored in the study. On the first level, factors that influence the parish employees' acceptance and utility of the GIS infrastructure are analyzed in the study. Analysis of their requirements for GIS resources and experience with current GIS implementation are important for developing future GIS implementation strategy to avoid previous problems. On the second level, the author spends more efforts on analyzing the parish department manager's attitude to GIS implementation and their requirements for the GIS application. Findings from the study will be used for supporting the GIS Department in designing its new GIS implementation strategy for the parish.

### **Methodology**

The study, conducted in April 2002, begins with an on-line GIS usage survey to parish government employees through the parish local area network (LAN). Responses are automatically stored into a web database for future analysis. A series of interviews are held with both GIS developing team and parish department managers in those areas that having some potential of using the new model of GIS implementation. Additional data include GIS task reports, memos, letters, minutes, and agenda. This method allows the author to collect a broad range of data in some depth.

In designing the survey, the first issue is to determine the variables that may influence the user's acceptance and utility of GIS. Henry C. Lucas Jr. 's descriptive model of using an information system is

a good starting point. In this model, there are four classes of independent factors, in terms of system quality, user's attitude, decision style and personal factors, affect the use of the information system. Lucas addresses that user's attitude and decision style are the strongest factors that directly influence the user to use an information system. User's attitude to a system, whether it is positive or negative, will directly affect his/her performance with the system. Even in case a mandatory policy for using the system is adopted in an organization, negative response of the organization member may result in limited acceptance or misuse the system. The attitude of the user depends on user's needs for information and how well the user understands the potential of the system for his/her work. A strong need for data processing may encourage the user to use the information system. In addition, user is more likely to use the system if he/she involves the system designing process and has an in-depth understanding of the potential of the system to benefit his/her job. User's decision style is another important variable influencing the use of an information system. A decision-maker who favors a rational method to use information in decision-making is more likely to use the information system. On the contrary, an intuitive decision-maker may ignore the information provided by the information system. In this study, parish employee's attitude is measured by how the employee considers the role of geographic information in his/her job, the status of using of geographic data in daily operation, and experiences with the current GIS implementation. Employee's decision style is measured by whether or not the employee maintains the geographic data for his/her own use in the job. The employee who bears the responsibility of maintaining geographic data is more likely to use GIS.

Following dimensions are investigated in the survey: the first part, from item 1 to 6, is about the role of geographic information in employee's daily operations. Questions include the status of the parish

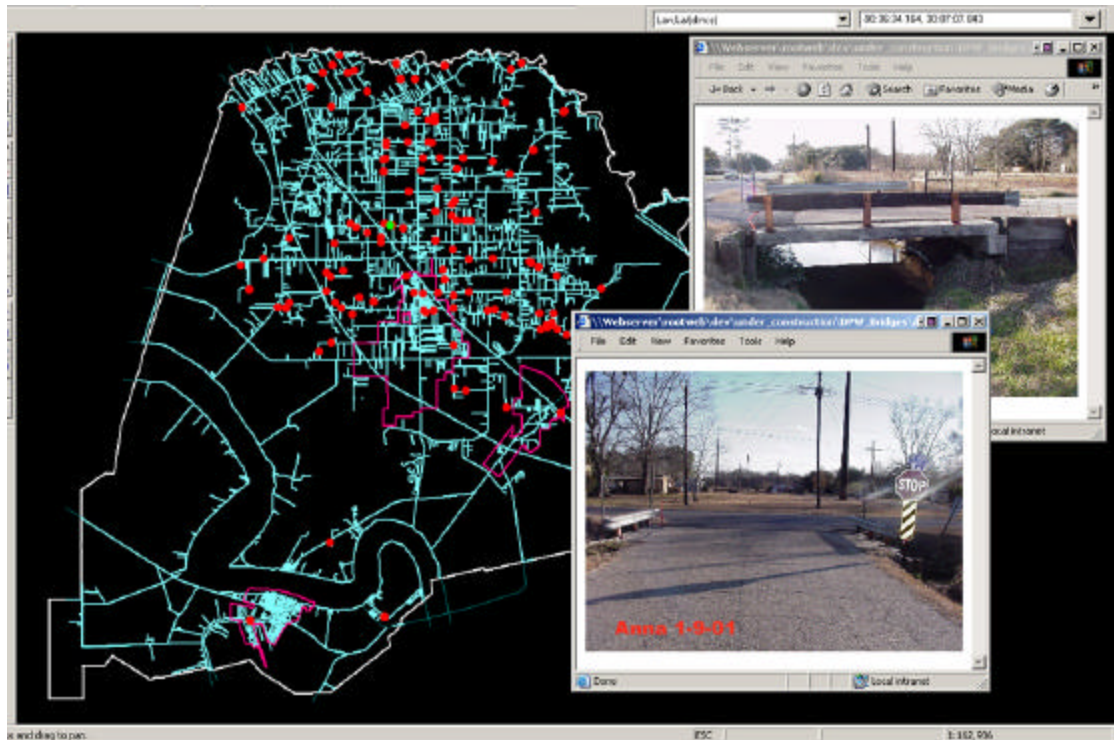
employee's use of geographic information in the work and methods to obtain the information. The second part, from item 7 to 11, is about parish employee's experience with the current GIS implementation. The third part was about employee's personal factors, including previous experience with GIS, intention to attend GIS training, and length of time in current occupation.

### **Result and Analysis of the Survey**

There are thirty-nine responses received by the GIS Department. Employees who reply to the survey mainly come from Department of Public Work (D.P.W.), Department of Planning and Development, Department of Finance, Mental Health, and Office of Parish President. In these departments, most employees use computer and network intensively in their job. Result of the survey indicates that eight-nine percent of employees consider the geographic information is important or useful in their job. Frequently used information includes municipal address, street map, and aerial photographs. Flood zone information is strongly required by employees to be added into the parish GIS database. Searching the parish network or hard copy archives are two main methods for parish employees obtaining geographic information. Sixty percent of employees know the browser-based GIS searching tools in parish LAN and have experiences in using them. Sixty percent of the employees agree that these tools are useful for searching data and satisfy with the design of the application. Access to these tools is the major concern for those people who have no experiences in using them. People who have previous experiences in GIS display more interesting in attending GIS training session and want to learn more. No evidence shows employees' length of service time makes difference in using GIS in their job.

Employee's decision style is measured by whether or not the employee maintains the geographic data by self. This factor is strong for determining the employee's acceptance and use of GIS.

Comparing analysis is made between these two different groups of people. There are nine employees who maintained geographic data for their own use. Among these nine employees, three come from Department of Planning and Development, two from Department of Public Works, others from Health and Social Service Department, Office of Parish President, Office of Secretary, and Department of Mental Health. Seven of them regard the geographic information is important for their job. Searching the parish network as well as maps and hard copy archives are two main methods for them to obtain the useful data. Examining how the geographic data is used in their job provides useful information for GIS Department in defining its future GIS application. For example, one employee from the Department of Public Work uses the geographic data to set up and update off-system bridges information. Figure 8 displays a GIS application developed by GIS Department for Department of Public Work managing the bridge information of the whole parish. One employee from Office of Secretary uses geographic data to answer inquiries from the public. The Department of Health and Social Service uses geographic data to update the location of the churches in the parish. Six of them, or sixty-six percent, have experiences of using the browser-based GIS searching tools, higher than the fifty-two percent of the other employees in the survey. Among these nine employees, five of them, or fifty-six percent, have used GIS before, higher than the forty-eight percent of the other employees in the survey.



(Figure 8. GIS application for Department of Public Work managing information of bridges in the parish. Small pictures are taken by the staff regularly and connected to the “hot point” in the map.)

## Result and Analysis of the Interviews

A series of interviews are held with the GIS developing team and parish department manager in those areas that having some potential to use the new model. Interview questions are served to investigate the manager's perception and attitude to the new model, and how these factors influenced the manager's acceptance to the new model.

Data from the interviews indicates that manager's decision-style, manager's experience with previous GIS implementation, and awareness of GIS potential directly influence his/her attitude to accept the system. For example, interviewing the manager of the Department of Finance indicated that there could



be a great opportunity for the department to obtain benefits from using GIS technology. One of major duties of the Department of Finance is to help the possible investors, either from the parish or from the outside, to find desirable rental building and developing sites. Criteria for site selection includes: area, length of the front line, site conditions, flood zone, access, zoning, environment, utility, and community issues. Information of the selected site and alternatives are filled by department staffs in a standard form and forwarded to the investor with a map for consideration. In addition, Department of Finance keeps an inventory of potential sites. The information of those sites is maintained and updated in a regular period. GIS technology can be very useful in supporting the decision-making in site selection. The manager of the Department of Finance claims that she has a comprehensive understanding of all the potential sites within the parish. In most case, she performs the job very well with her personal knowledge. Additional data can be obtained by inquiring from other departments, for example the GIS Department. In fact, a GIS program and a stand-alone database are installed in her computer, but she seldom uses the program. First, she still has some problems in using the program. Second, she is not confident with the information in the database because it is not updated in time. The GIS staffs demonstrate the pilot project of Web-based GIS to her and suggest her to attend a training session. After taking the training one month later, she says she gets some basic idea of GIS and shows interesting to participate in Web-based GIS application development. GIS developing team members convince her that the success of the development depends on the quality of the information. It requires the efficient data exchange between the GIS Department and other departments. Designing the user's interface is important for improving the use of the system. It depends on how well the communication is between the GIS developers and client department. This requires that the department manager and other staff

members have a clear idea for what they want from the system and how well the GIS developer translates these requirements into the system design. For the data access issue, the manager of Department of Finance does not want the public to access the data that belong to the Department of Finance, for this may threaten its cutting edges. In the standing point of the GIS Department, a shared database among the parish government is part of the objective of the system. The GIS Department prefers a centralized data control by the parish. In this way, the parish government can still keep the data even if key staffs leave their position.

### **Implication**

Findings from the survey and the interviews show that manager's decision style and knowledge of GIS directly influence his/her attitude to accept and use the system. In some cases, manager's attitude will also affect other staff members' behavior. For example, among all of four responses from the Department of Finance, only one member mentions that geographic information is important in the job. None of them maintain the geographic data in their daily operation and none of them show interesting to attend the training session of GIS. Although no evidence indicates that staff member's response is directly influenced by its manager's attitude, the situation in the Department of Finance implicates the connection between these two sides. For GIS developer, seeking support from the department manager is important to establish a group norm for GIS utility in that department. Once using GIS is established as a policy in the group, more staff members may change their attitude and turn to use GIS.

## **Chapter 6. Web-Based GIS Concept**

The objective of this chapter is to introduce a new model of GIS implementation, Web-based GIS. First, a brief history of GIS technology development is reviewed. GIS technology was initially used by government agencies in early 1960s. In 1980s and 1990s, GIS technology experienced a significant change due to the development of Personal Computer (PC) technology and Database Management System (DBMS). Up to date, GIS technology has been diffused to many areas, both in public sectors and private sectors. Rapid growth of GIS users brings significant requirements for access to geographic data. On the other hand is the growing need for user-oriented GIS applications. The end of the last century see a fast improvement in Internet and WWW technology and brought new opportunity for distributing both geo-processing tools and geographic data to a wider range of potential users. The Web-based GIS efforts in Ascension Parish GIS Department reflect this new change.

### **Concept of GIS**

Although an accurate definition of Geographic Information System (GIS) is still on debate, today, GIS is used as a generic term referring to a wide range types of applications for manipulating geographic or spatial data. Generally, GIS is defined as an information system for capturing, storing, manipulating and analyzing the spatial information. Three issues arise in spatial information management. The first issue is about data entry, or how to represent the information for gathering and storing. Information of the spatial objects can be divided as spatial data and descriptive data. Spatial data is used to describe the location, shape, and topological structure of the spatial objects. Descriptive data is used to describe the attributes of the spatial objects. Traditionally, spatial objects are represented with maps or images. When a computer

system is used, the spatial data are represented with graphic symbols in digital format, whereas the descriptive data are represented with text in tabular form. The second issue is about the methodology of data processing, or what kinds of performance the user can do with the information. Typical geo-processing includes retrieving the data for fact-finding, querying the data with criteria, spatial analysis and modeling, topological operating, and network analysis. The third issue is for data output. The output of the data processing can be in either paper map or digital format depended on user's requirement.

Before GIS technology emerges as the primary land information management system, various types of computer systems have been used for managing information of spatial objects. Many functions of those computer systems have been incorporated into the GIS. Examining the advantages and limitations of those systems is helpful for people to understand the developing trends of GIS technology. Among these systems, I highlight four. They are automated mapping (AM), computer-aided design (CAD), land information system (LIS), and automated mapping and facilities management (AM/FM).

### **Automated Mapping (AM)**

The AM technology is used for drawing and producing maps automatically. Graphic software is used to create, edit, and manipulate cartographic data. It emphasizes the graphic representation of geographic data. The AM technology does not have the capability to store and manipulate descriptive data of spatial objects.

### **Computer-aided Design (CAD)**

CAD technology is widely used by engineers, architects, landscape architect and planners to create, modify, and manipulate drawing. CAD technology focuses on the spatial data

presentation. Unlike the AM, CAD technology does have limited database capability to store and manage the data.

### **Land Information System (LIS)**

LIS is widely used by local government to maintain survey information of the parcels. The information including the property ownership, construction date, land assessment, and land taxation. The information stored in a LIS is usually in tabular form. Each record has a unique key for identification. Typically, the LIS technology lacks the capability to manipulate graphic data.

### **Automated Mapping and Facilities Management (AM/FM)**

AM/FM technology incorporates two sets of technology: automated mapping (AM) and facilities management (FM). The AM is used for producing maps, whereas the FM provides digital inventories of the facilities. The AM/FM technology is widely used for managing municipal utility information that requires a high level of data accuracy. The AM/FM technology has capability to manipulate both graphic data and descriptive data. But the AM/FM lacks the capability to perform spatial analysis and modeling.<sup>10</sup>

Compared with those tools, GIS seems to be an all-purpose tool for processing spatial information. Several characteristics can be identified from the definition of GIS. First, GIS is an information system. In most current commercial GIS, a database management system (DBMS) is used for managing the information. A major difference between GIS and other information systems is that GIS can simulate the real world with its capability to construct and maintain the relationship between geographic information and descriptive information of spatial objects.

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<sup>10</sup> See Huxhold, 1991 "An introduction to urban geographic information systems" New York, Oxford University Press p24

Second, GIS has the capability to handle both spatial data and descriptive data of the spatial objects. Generating map and information management are two major functions of the GIS. Third, the difference between GIS and AM/FM is that GIS focuses on spatial analysis. GIS is designed for almost all performance that the user can do with the geographic information. These characteristics of GIS make it an especially useful tool for managing urban land information.

Main components of a GIS project are hardware, software, and data. In its three decades development, all significant technical advances in these components have impacts on the evolution of GIS technology. Hardware associated in GIS includes all devices for gathering, storing and manipulating the data. Scanners and digitizers are tools for data input. PCs, workstations, servers, and networks are devices for running GIS software and data storage. Printers and plotters are used for data output.

GIS software can be divided as two types: one is for processing the graphic data on the front side of a GIS. The other is usually a backbone database for storing and maintaining the GIS data. For example, Intergraph's MGE package uses Bentley's MicroStation for inputting the graphic data and an Oracle database for managing the information. In ESRI's ARC/INFO, the ARC handles the graphic map features and the INFO components handle the information system. In a GIS project, data processes are divided into data input, data manipulation and analysis, and data output.

- Data input or data entry. The supply of spatial information to a GIS can be either graphic data or non-graphic data. The graphic data includes CAD drawings, scanned and geo-coded paper maps, remote-sensed images, and digitized maps in other formats. The non-graphic data are

descriptive information of the spatial objects such as the demographic, land ownership, land use, zoning, and municipal addresses etc.

- Manipulating and analyzing the data are the performances that the user can do within a GIS. They include defining the data set for map features, constructing relationship between spatial data and descriptive information of the spatial objects. Spatial analysis functions include querying data with criteria, buffering, topological operating, network analysis and 3-D surface analysis.
- Data output. The GIS is powerful in visually presenting the spatial information. The output can be either in paper maps or in digital formats.

Raster data and vector data are two main data structures used in GIS. Sometimes, GIS is categorized as raster GIS or vector GIS for its different capability to deal with these two data structures. The raster data is a matrix of cells in which each cell has a value to represent a square parcel of the real world. The vector data is a data structure that spatial objects are represented by symbols with geographic coordinates. The main difference between raster data and vector data is that raster data is useful for continuous data in the space (e.g. elevators, population density), while the vector data is useful for discontinuous data in the space (e.g. land parcels, census tract, and buildings) with distinct boundaries. Vector data and raster data can be converted to each other. Paper maps can be scanned and transferred into raster data. Raster images can also be converted into vector map by identifying the edges of similar value groups.

Main raster data includes aerial photos, orthophoto, and remote-sensed images. The raster data can be used for directly data processing and analysis in a raster GIS, or it can be used as a backdrop in a vector GIS. In a vector GIS, each spatial entity is symbolized as a map feature. But

the GIS does not store any graphic map, it only maintain the topological relationships of the spatial data in the database. Map features are grouped as feature classes according to their attributes. A feature classes is like a template or mold, new features is created with the template. In the database, a single table is a feature class. The columns of the table are attributes of the feature class. Each row of the table maintains all the records of one feature belong to that feature class. One of the attribute fields is used as unique key field, called primary key, for distinguishing that feature from others. The data fields in a table can be divided into two types: spatial data and non-spatial data. Spatial data contains all geographic information of spatial entities, including geographic coordinates, rules, and symbols that define specific cartographic elements on a map. Symbols include points, lines, strings, and polygons. A point can represent a mailbox, a building, or a city. Lines are used to represent streets and grids. All boundaries and waterways can be represented with strings. Polygons are used to represent a spatial area with a single value; it can be a parcel, a census tract, a county, or a state. Non-spatial data are attributes of the geographic features. In graphic user interface of a GIS, the feature class table is projected as one map layer. By overlaying the map layers, GIS can query the database and perform basic spatial analysis tasks such as buffering, topological operating, and network analysis.

Two significant changes in computer technology contribute to the development of the modern GIS, Personal Computer (PC) and relational database. In its early year, GIS was adopted in a central computer, known as the mainframe, with a large number of terminals attached to it. Several drawbacks exist in the centralized GIS. First, the mainframe system tends to use unique operating system that limits the portability of software and data. Machines with different operating system are difficult to integrate in to the centralized system. Second is the high price of



keeping large database on the mainframe system. The development of personal computer (PC) brings the fast growth of desktop GIS. With introduction of PC and desktop GIS, the functions of the former centralized GIS can be moved into a single computer without sacrificing the performance. In the mean time, the cost of hardware is significant lower than before. It enables more organizations and individuals to use GIS.

In the software, one of the significant developments is the introduction of the concept of the relational database in the 1970s. Different from the centralized database in the mainframe system, the data sets in the relational database are distributed so that the data sets are separated into more than one computer linked by network. The user can map the network data source as if it is on the local drive. The advantage of a relational database is that the speed of data processing is faster while the system resources, such as CPU processor and memory, can be used more efficiently.

Another software advances in the GIS is the Graphic User Interface (GUI). Currently, most GIS programs have graphic user interface as it is commonly used in most windows-based programs and CAD programs.

### **Internet and WWW Technology**

Probably the most fascinating development in information technology is the advance of Internet and World Wide Web (WWW) technology in the end of the last century. In this paper, I will not make a detailed discussion of Internet and WWW technology. Instead, the paper will address the impact of Internet and WWW technology on future GIS development. By reviewing the previous GIS efforts, two developing trends can be identified. First, the rapid growth of the GIS users requires geographic data to be distributed efficiently and effectively to a large number

of the users. Second, as GIS technology is diffused to a wide range of areas, there is the need to develop more flexible user-oriented GIS applications for specific requirements.

The Internet allows remote computers to communicate with each other around the world. The World Wide Web (WWW) is a combination of numerous resources that can be reached on the Internet. What essential to the WWW are network protocol, hyperlink, and Uniform Resource Locator (URL). Generally, each website has a unique address on the Internet. It is called as Uniform Resource Locator, or URL. The Internet user can reach the website by using this unique address. Each website is made up with a number of web pages that interconnected with hyperlink. The network protocols allow the Internet user to move from one web page to another with the hyperlink in the web page.

Using WWW is an efficient way to distribute geographic data to the public. Anyone who is interested in using the GIS resource can access it if he/she has connected to the Internet and knows the address of the useful websites. For example, the U.S. Census 2000 data are available in the website of the U.S. Census of Bureau. The data are stored in ASCII format and text format. People can go to the website and download the data to their computer and transfer into a GIS program. On the other hand, geo-processing tools can also be distributed through the Internet. There are two ways to do this. First, the web page is used as a form to collect the user's request. Then the web server processes the user's request and returns the result to user's web browser. For example, on the website for path finding, user types the address into the request form, the server processes user's request and returns the description of the path and a map to user's computer. Some websites even have more sophisticated GIS application. For example, on the website of [www.geocode.com](http://www.geocode.com), when user types in an address, the web page can display the

longitude and latitude of the address as well as a small map. The second way is that GIS application program can be directly moved to user's computer when the user opens the web page. In this way, part of the job previously run on the server can be moved to run on the user's computer. This will significantly reduce the data flow between the server and client computer and cut the user's waiting time for responses from the server.

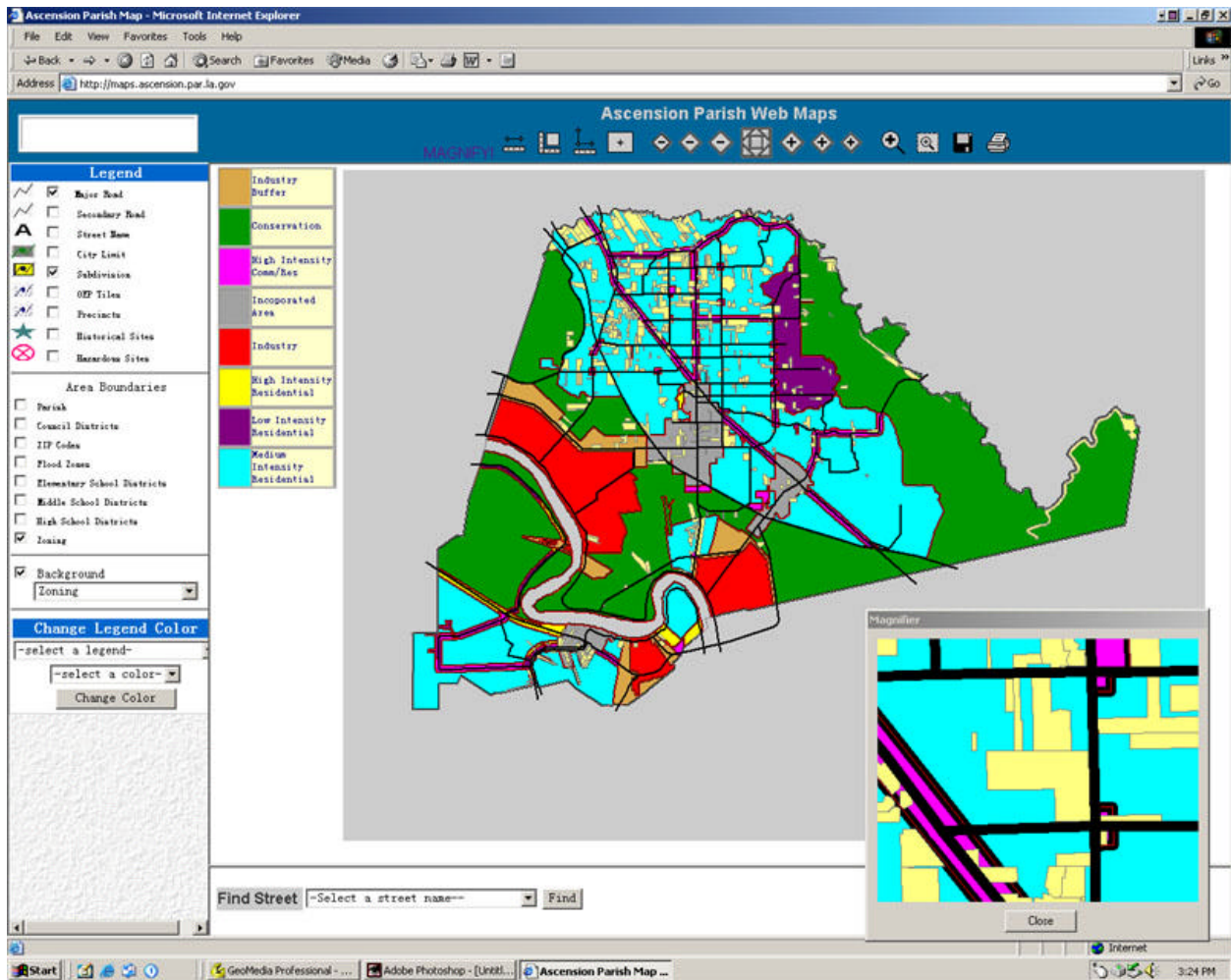
### **Concept of Web-GIS Implementation**

The concept of Web-based GIS is not so complex. On the server side resides the GIS database and applications to process the user's request. On the client side is a user interface within a web browser. Whenever a user submits a request, the server processes the request with the GIS application program and returns the result to user's computer. Web-based GIS implementation in local government has the following advantages. First, the geographic data can be distributed to both government agencies and the public if the system is running on a server connected to the Internet. Second, centralized GIS database reduces the data redundancy and discrepancy. In case updating the information, only one update on the central database is necessary, no needs for duplicated work. Third, flexible and user-oriented applications can be developed to improve the utility of the GIS resource and this is the essential part of the Web-based GIS.

One thing needs to clarify is that the purpose of Web-based GIS is not to translate conventional GIS functions into the website. Instead, it is the user's operation that is translated into the website to make an easily-understood-and-used interface for the user to use the GIS resources. This requires the developers to have an in-depth understanding of user's needs and working method. User participant is very important for Web-based GIS implementation. The success of Web-based GIS application design is not only related to technical issues, more

attentions should be paid to studying the user's behavior, small group value, and organization structure. In this meaning, the design of the new model is of more art rather than scientific (Figure 9 displays the Web-Map project of the Ascension Parish).

In a summary, the development of GIS technology depends on the advances of computer technology. GIS has more advantages than other computer systems in managing urban land information. The development in the Internet and WWW technology brings new chance for the evolution of GIS. Web-based GIS can distribute the geographic data and GIS application to a broader range of potential users that the conventional GIS implementation may never reach. The flexibility of the Web-based GIS can create more user-oriented application to encourage the use of GIS resources. In next chapter, the Web-based GIS implementation in Ascension Parish Planning Department will be discussed as an example.



(Figure 9. Ascension Web-Map on line information system shows a subdivision map of the parish, webpage can be access at <http://maps.ascension.par.la.gov/>)

## **Chapter 7. Implementation Strategy and Application**

This chapter is a report of a proposed plan for designing a Web-based GIS application to process development permit application in Department of Planning and Development in Ascension Parish Government, Louisiana. The report will be used to support the effort of GIS Department's in Web-based GIS implementation in the parish government. The report includes three parts. The first part is a study of the urban land use planning program in local government and application of GIS technology in land use planning. The second part is a feasibility study of Web-based GIS application in Department of Planning and Development. In this part, the procedure of processing development permit application is examined in the perspective of data flow within the parish government. Problems of the current status of procedure are identified and Web-based GIS solution is introduced. The third part is an evaluation study of the Web-based GIS solution as well as impact analysis of Web-based GIS application on the Department of Planning and Development with the three-level evaluation framework introduced in Chapter 1.

### **Introduction: Urban Land Use Plan and Spatial Information**

Based on the analysis of the data collected from the survey and interviews, the GIS Department set the Department of Planning and Department of Public Work (DPW) as the highest priority for developing Web-based GIS application. Interviews are held with the staff members from these two departments to collect the data of their specific requirements. Designing ideas are exchanged between the GIS developing team and the client departments. Frequent user participating and feedback are involved during the interim of the designing process.

An urban land use plan is a decision making process that the local government determines the future land use pattern of the community. The planning document is used as a guiding policy for

the legislative body of the local government to exercise the power of land use regulation. Urban land use planning has the following characteristics. First, the planning document is a guiding policy for the local government, not a land use law. Contrary to zoning regulation, land use plan is not mandatory. In a local government, the role of the plan is to provide a rational basis for the legislative body of the local government to exercise the zoning power; whereas the zoning is a tool to help the community implement the plan. Second, the plan is future-oriented. The purpose of the plan is to guide the future development of the community to best benefit the public interests. The future goal and specific objectives are defined by analyzing the existing conditions and future trends. The plan also establishes the methods to guide the local government to achieve the goal. Third, the plan is comprehensive. A well-accepted fact is that the living environment of the human being is a system in which the parts of the system are interrelated to each other.

Problems of a single part will affect the other parts of the system and cannot be solved with a one-to-one solution. This requires a comprehensive plan to identify the problems and generate alternative solutions for the whole system. Fourth, the plan is a process, not a final description of the future situation. On the one hand, the plan usually spans a long period of time. This requires the plan must be flexible to deal with the unforeseen problems. Except the long-term and intermediate term goals, short-term goal should be defined in a plan for immediate response to the existing problems. The future goal and methods defined in the plan should be regularly revised during the interim implementation of the plan. All these situations determine that the plan be an iterative process instead of a static blueprint for the future development.

In local government, a planning commission is responsible for making the land use plan. The planning commission hires a professional staff, the planner, to execute the operation of planning

practice. The planner plays a unique role in the planning process. The planner, first, is the one who drafts the proposal planning documents for the local government with his/her practical experience and professional knowledge. On the other hand, the planner participates in the daily planning implementation such as evaluating the development application and issuing the permits for the development. The role of the planner requires he/she has a comprehensive understanding of the community, knowing what is important for the public sector as well as the private sectors; on the other hand, the planner should be sensitive to the changing methods and technology development in the planning practice. Today, the role of the local government in the urban land use planning is more to provide the policy for guiding the business activity rather than direct intervention in urban land development. This situation determines that planning be an iterative process rather than a final static blueprint. Capabilities of information analyzing, problem solving, and decision-making are essential for the planner.

Other types of planning participants include business community, government, interest groups, and general public. They have different perspectives on land use value. The business community includes landowners, developers, realtors and bankers who see the urban land as a profit commodity. The government, whether at federal, state or local level, requires the plan to benefit the public interests. Specific interest groups, concerning for particular problems such as environment and local character conservation, have obtained more and more influence in the planning (Kaiser 1995). Those planning participants use their forces to influence the outcome of the planning process. In planning practice, the planners have to deal with the different requirements of other planning participants, and in most cases those requirements are in conflict with each other.



Of all the theoretical models for the planning process, the 'rational plan' theory is widely accepted and used by the planners. Typically, rational planning is described as a process embodies an analytic phase in which the problem is explored, followed by a synthetic phase in which the solution is devised or generated. In this model, the planning process can be divided into the following steps: identifying problems, analyzing goal, generating alternatives, implementing the plan, and monitoring and revising the plan. Spatial information is essential for each step, especially the analytical phase of the planning process. In this meaning, 'rational plan' can be seen as a series of data-driven procedures. In the remainder of this section, the rational plan model and the associated spatial information are examined.

- **Problem identification** The need for a new local land plan or revising the existing plan usually comes from the requirement of land use change. The practice of land use planning is actually to monitor and manage the land use change. In the step of problem identification, the planner should answer the questions of where the changes occur and how the changes take place. A wide range of information needs to be collected. Typically, population growth requires new settlements as well as additional location for public services. Economic opportunity and employment attract the migrants. The existing urban land use needs zoning or rezoning. Transportation improvement prompts the land value and brings potential profits in urban land market. Information associated with those issues includes demographic, economic and employment, current land use map and historic land use records, existing conditions in environment, transportation, public services and infrastructure. The tasks of the planner are to analyze the

information gathered to identify the present problems and future trend and address those issues in the plan.

- **Goal analysis and specification** A land use plan is focused on the future. The goal of the plan is to define a future land use pattern that balances the social, market, and environmental value of the community. Kaiser (1995) summarizes five types of goals in the planning process:
  - Legacy goals come from previously and currently followed policy of the local government; they are a good starting point for the goal-setting process.
  - Mandated goals “musts,” come from state and federal policy and from the judicial system’s interpretation of statutory and constitutional rights.
  - Generic goals “oughts,” come from political philosophy and the planning literature on good urban form, good land use management, and good governmental process.
  - Needs are goals for accommodating change and derived from forecasts of population and economic change that must be accommodated.
  - The community’s concerns and aspirations, “wants,” are derived from a participatory goal-setting process.
- **Generating alternative and making decisions** Once the goals and specific objectives are defined, the planner designs different development scenarios to illustrate alternative future land use patterns. In this step, the task of the planner is to synthesize the information collected and other facts gathered by communicating with the Planning Commission or the local government. The planner needs to derive location requirements for future land use, find available urban land supply for particular use, estimate space requirement, analyze the holding capacity of the available land, and generate alternative scenarios of the future land use pattern. The planner evaluates the alternative solution by weighting the impact of the proposal on the goal defined in the previous step. The Planning Commission discusses those alternative scenarios and makes the judgment.

Policies are established to guide future land use to avoid the problems identified or reduce the consequences of the existing problems.

- **Implementation of the plan** Translation of the plan into action requires three steps: First is to develop public support for the planning policy. Citizen participation and public hearings are conducted for the public to review the plan. The plan may be amended or revised before adoption. Then the legislative body of the local government adopts the plan as an advisor policy or legal binding document for the basis of any land use regulation. Once the plan is adopted, more detailed policies, zoning ordinance, subdivision regulation, and development programs are developed by local government to implement the plan (Juergensmeyer et. al. 1998).
- **Monitoring and revising** This step is the end of the planning process, but it has always been the beginning of the next iterative process of planning. In this step, the planners concern is for the same spatial information as in the problem identification step.

GIS has several advantages in managing spatial information in the planning process. First, most information involved in planning process has geographic reference. Location attributes of the spatial objects are the main issues considered in the planning. GIS is a powerful tool to manage the information used in planning process. Second, the local government usually maintains different types of information in its different branches. Using GIS can efficiently integrate and share the data of different formats across the whole organization. Third, public participation is important in planning process. Planning issues and policies need to be accessed in an effective and efficient way for planning participants, especially when combined with

Internet technology. GIS has powerful capability in graphically displaying the spatial data. Using GIS can facilitate the interaction between the planners and other planning participants.

### **Findings and Interpretation in Ascension Parish**

The Department of Planning and Development in Ascension parish adopts a standard procedure for processing development permit application. To obtain land use and development information, it requires the developer have an intensive communication with the government agencies from multiple departments and submit a large volume of paper documents. The procedure begins with a preliminary plat submittal to the Planning Department. The developer need contact the land surveyor, review engineer agencies, and utility company to prepare the submittal documents including the following information:

- Title: proposed subdivision name, location of the property, name of the developer, property owner(s), engineer, and/or land surveyor
- Boundary lines and existing improvement: Boundaries of the subdivision location, names and width of adjoining streets, section and township lines, indication of incorporated areas, sewer districts, zoning districts, school districts, and other legally established districts, all water courses, drainage ditches, wooded areas
- Adjoining property: names of all adjoining subdivisions, names and address of record owners of unsubdivided property, names and addresses of record owners of record owners of adjoining properties to and touching the proposed subdivision
- Features of proposed subdivision: proposed location names and width of streets, layout and approximate lot dimensions, servitude, location and dimension of existing buildings, front-building lines
- Drainage ditches: existing drainage ditches, proposed ditches from proposed subdivision to ultimate drainage channel
- Street: statement of proposed street improvement, contour map where terrain might affect location of street
- Special use areas: location and size of proposed parks, playgrounds, churches, school sites, or other special land use
- Vicinity map showing existing streets, roads, drainage channels, and buildings within 1000ft. of the proposed subdivision
- Flood zone delineation
- Wetland determination
- General: existing covenants, land characteristics, available community facilities and utilities

A unique planning commission number is assigned to the preliminary plat for identification when the Planning Department receives the documents. Then the preliminary plat and supplemental materials are reviewed by planning staff, DPW and other parish agencies to determine whether the proposed layout of the land in question is satisfactory from the standpoint of public interest and will meet the requirements of the land use regulations. The planning office sends certified letter notifications to the owners of adjacent properties regarding the proposed subdivision. Copies of the plat with red ink mark up are forwarded to parish engineer and DPW for revising. The Planning and Zoning Commission will review the preliminary plat, supplemental materials, and comments from the planning staff, the engineer review agency and DPW. The Planning and Zoning Commission will discuss the plat as to conformity with the subdivision regulations. Public hearings are held on all major subdivisions. Notice of the time and place of the public hearing is mailed to the developer and all adjacent property owners by the planning commission staff. The public hearing is also advertised in the official journal. The developer and/or his representative shall be present at the public hearing to explain the proposal and answer questions. Once the preliminary plat is approval, the developer may direct his engineer to proceed with the construction plans. During the construction, the parish engineer and DPW shall conduct regular inspection with the construction to conformity with the approved plan. When construction is complete, planning staffs notify telephone companies of new streets and proposed addresses for E-911 purposes. After one-year waiting period, the final plat is submitted to the Planning Office for final review. The plat undergoes a final review for accuracy and completeness. Municipal addresses are assigned to lots by the planning staffs in conformance to the 911 grid. They are not entered into any database until a building permit is

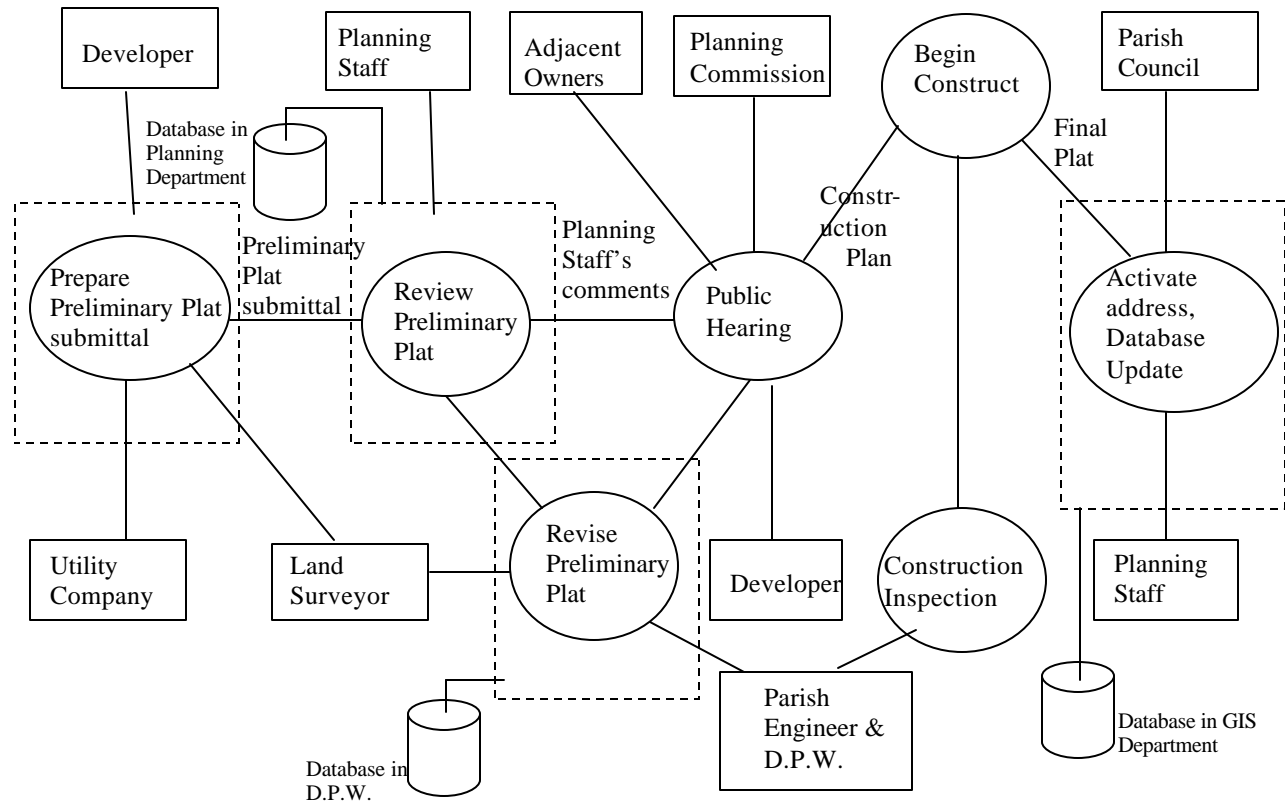
request for that particular lot. The plat is recorded at the Clerk of Court's office and copies are forwarded to other departments including Department of Public Work and the Assessor.

Department of Planning and Development maintains a 'plat transmittal list' on which it records the data, time, deed book and file number, and the recording and certification fees pertaining to each plat. Planning's master list of approved subdivisions is updated, as is the DPW's master road files, indicating their status. This is reported to the Planning and Zoning Commissioner and the Parish Council.

The data flow chart describes the permitting process procedure adopted in the parish. The ovals represent the process action; the arrows pointed to the oval stands for the input data; the arrows pointing from the oval stands for the output of the process action; and the rectangles represent the entities involving the procedure. Rectangles in dashed lines indicate the stages of the procedure.

Reconsidering the procedure as a data flow in the structure of local government, four dimensions of data flow within the procedure can be identified (the following table displays the data items and associated data process operation for the entities involving in the procedure). First is the data flow between the developer to parish agencies; the second is from planning staffs and other agencies to Planning Commission; the third is from Planning Commission to Parish Council; the fourth is between parish agencies. Examining the first dimension, one can see the parish government provides limited information to the developer with its existing resources. For the developer, collecting information for submittal documents is still a cumbersome effort. On the contrary, parish government does not use the information provided by the developer efficiently. The findings show a lapse of data flow exists in this dimension. During the interim of

the procedure, only the Planning Department maintains the developer's information. Other departments cannot use the information until the final plat is approved and updated into the database of the Planning Department.



(Figure 10. Data flow chart of information exchange in the procedure of processing development permit.)

(Table 1. Data items and operation for the entities involving in the procedure.)

	Input Data	Output Data	Operation
Developer	Information from land surveyor, engineer review agency, and utility companies.	Preliminary Plat and supplemental material; Construction Plan; Final Plat;	Preliminary Plat submittal Construction Plan Submittal Final plat Submittal;
Planning Staff	Preliminary Plat and supplemental material; Construction plan; Final plat	Comments on the plat; Updated database;	Review Preliminary Plat; Review revised plat; Review final plat; Update database
Other Agencies	Preliminary Plat and supplemental material And Planning Staff's Comments	Revised Preliminary Plat Inspection Impact analysis	Revise Preliminary Plat; Inspect Construction Plan; Traffic Study and Environmental Study;
Planing Commission	Comments from Planning staffs and other agencies; Developer's presentation;	Approval Or Not approval	Holding public hearing
Parish Council	Updated land use map, Land use changes analysis;	Land use decision	

A permit process system based on Web-based GIS model can facilitate the current procedure and promote the management of the information in the process. Three issues need to be considered in developing this system.

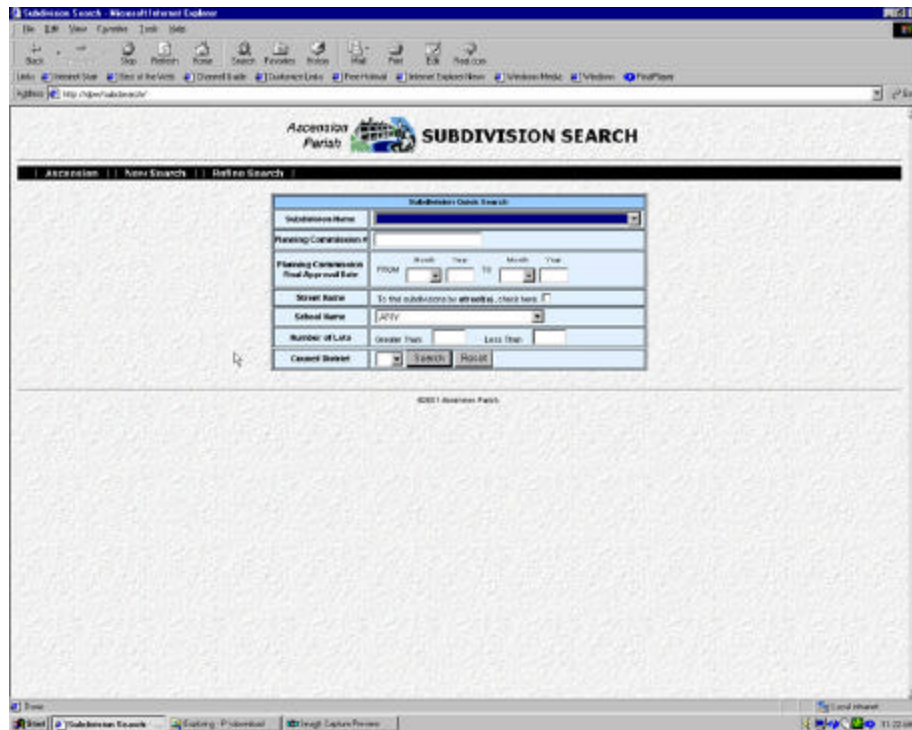
First is to integrate the subdivision information in the parish departments. Currently, three departments have the information. Department of Public Work maintains the subdivision information from 1994 and no historic information before that year. The Planning Department has more historic information. The GIS Department has a digital map for all existing subdivisions since December 1998. New information needs to be added into the GIS digital map.



Once an integrated database is constructed, all entities in the procedure will have a common database for reference. This will eliminate the data redundancy and discrepancy. Second, user interfaces need to be designed to connect with Web-based GIS resources for different departments in the procedure.

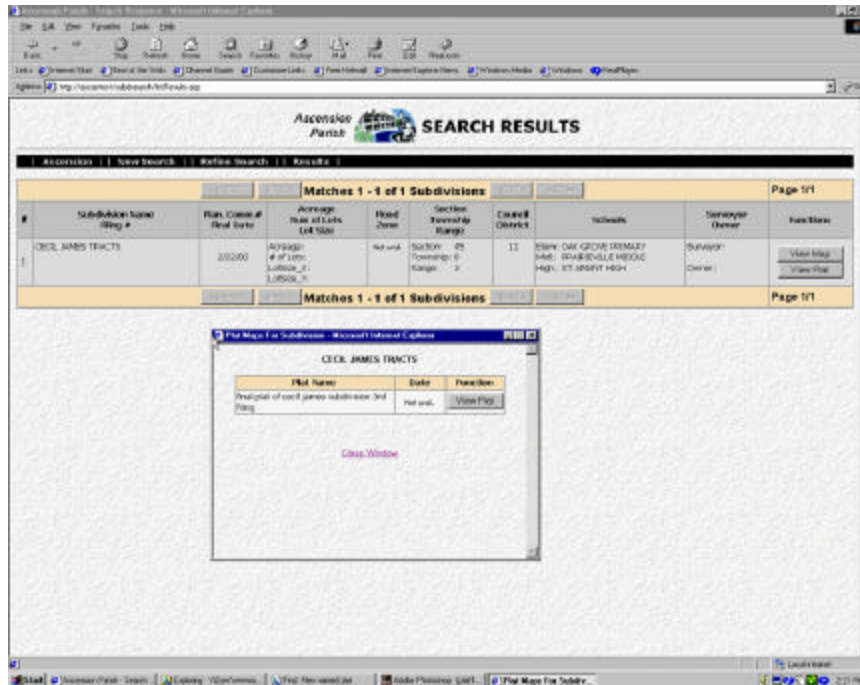
The interface for the departments can let the government agencies to trace the status of permit application, comments from other agencies, and enter the information to inform other agencies and the developer. In designing the user interface, existing browser-based subdivision searching tool on parish local area network can be a starting point. With this searching tool, parish government employees can query the information of all subdivisions that entered into the parish GIS database. Figure 11 displays the starting webpage of the subdivision searching tool. Figure 12 and Figure 13 show an example of subdivision search and its result. The difference between the subdivision searching tool and Web-based development permit process system is that the permit system can also let the authorized parish employees to update the information through the networks.

The third issue is the designing of the interface for the developers and the public to access the parish GIS resource for querying urban land information and tracing the process of the permit application. The quality of user interface design is one of the most important factors that affect the employee's use of the system. The objective of the Web-based GIS is not to translate conventional GIS functions into its user-interface. Instead, it is the user's operations to be translated into the interface to make it an easily-understood-and-used tool for user to access

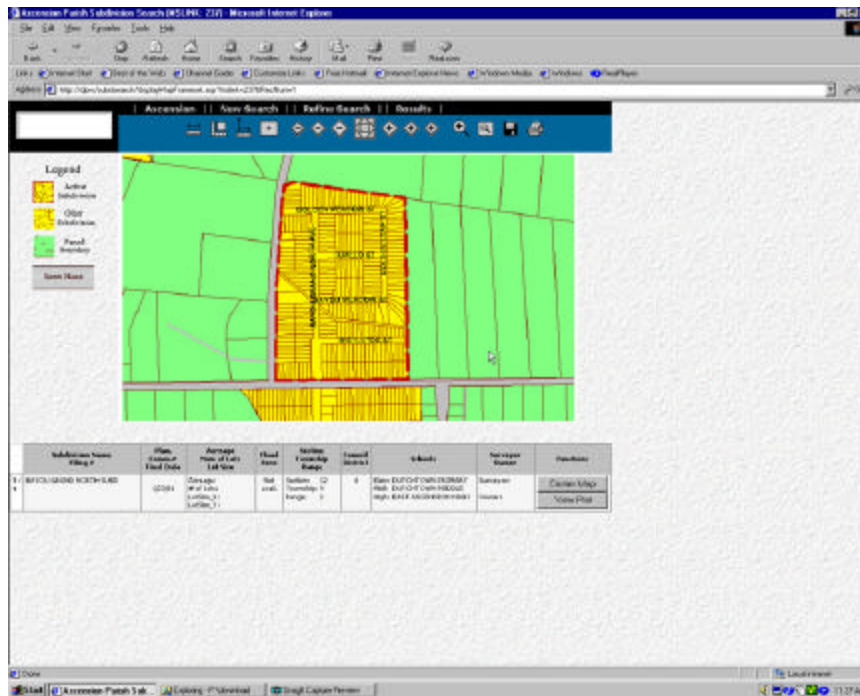


(Figure 11. On-line GIS search tool for subdivision search.)

GIS resources in its operation. This requires the Web-based GIS developer to have an in-depth understanding of user's requirements and working method in their daily operation. The success of the system depends on user's participants and frequent feedback to the GIS developing team. In designing the user interface for the public, because of no efficient way to have the public participate into the designing process, an alternative solution is to add an on-line feedback form in the parish Web-Map application to collect the response from the public. The responses are analyzed and the result can be used to support the design.



(Figure 12. Web page shows searching result of subdivision search.)



(Figure 13. Map presentation of the searching result of the subdivision search.)

## **Impacts Analysis**

Once the new system is adopted into the Planning Department, the following changes can be predicted by using the new system. Returning to the evaluation framework introduced in Chapter 1, on the first level, the system will facilitate the information process for development permit application because both the developers and the planning staff members are using the shared geographic data resources provided by the new system. It will reduce the workload of repeated reviewing and revising the submittal documents of the developers. On the other hand, the planning staff members will have to enter the information both in the paper form and in the digital form of the system. It will increase the possible mistakes for data entry and result in unforeseen problems. This situation requires the planning staffs have a more rigorous attitude when using the system because they are the interface between the public and other government agencies when processing the data. The positive change may be an improvement of the performance of the planning staff members and management of the Planning Department. Before further observation and evaluation of the system usage, this change cannot be guaranteed.

On the second level, for the Planning Commission, the system will improve the managerial control in the Planning Department. The Planning Commission can check the working reports of the planning staffs at any time. Currently, an on-line report function is still not available for the new system. A similar on-line monthly report has been used in GIS Department for the supervisor of the GIS Department reviewing the working status of the staffs. Figure 14 displays the on-line report of GIS department. In this on-line report, the staff members of the GIS Department input the work orders, such as map requests, and how they are finished into an on-

line database. The system creates the webpage of the report on the fly when the manager of the GIS Department and other authorized persons visit the web address of the report for review.

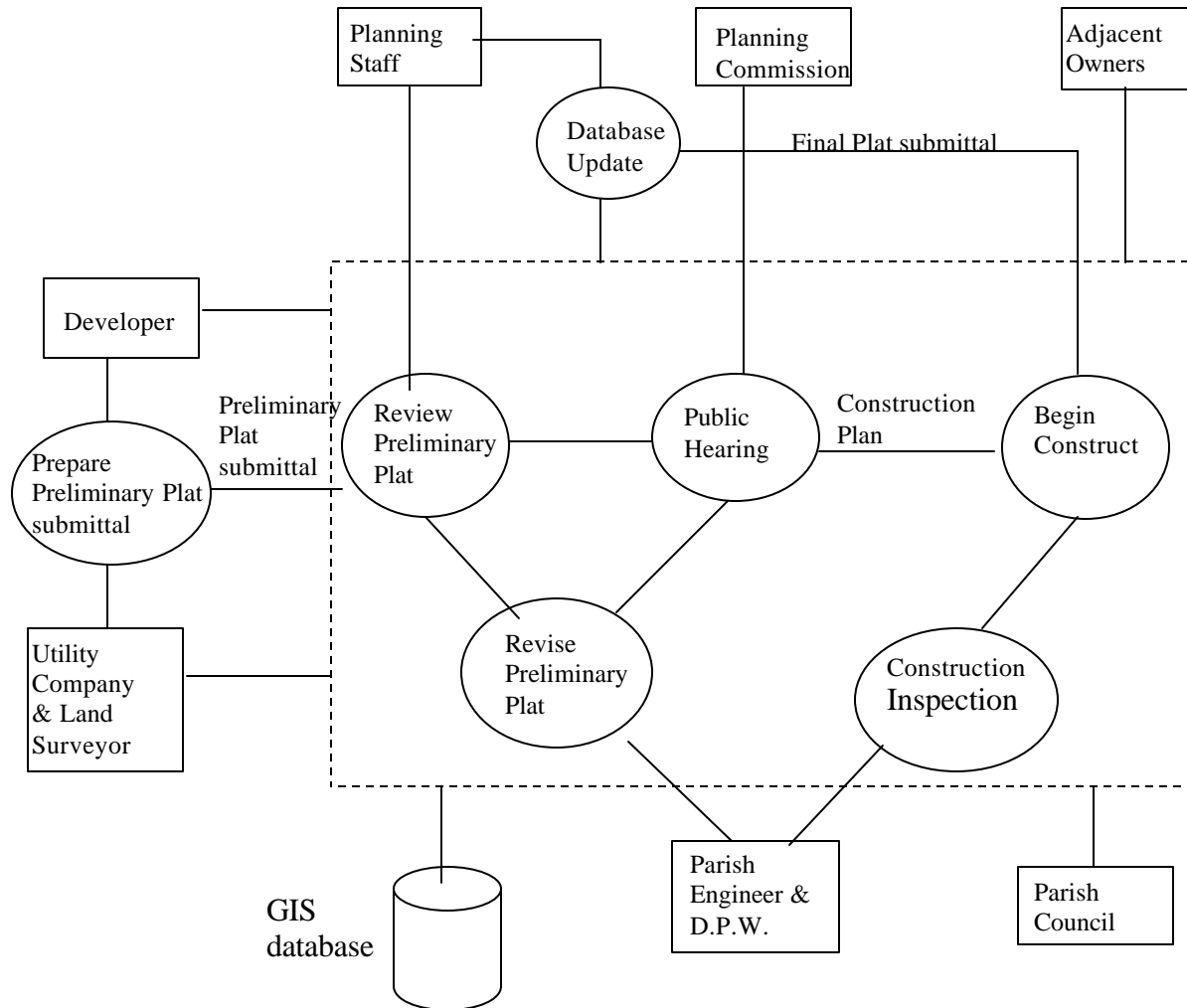
From the perspective of data flow across the parish government, or the third level in the framework, by using a common database across the parish government, data redundancy and discrepancy are eliminated. The planning staffs and other agencies can check each other's working status within this system to improve the efficiency of the processing. The long-term benefit from using the system is to integrate the data flow within the whole parish government



(Figure 14. On-line monthly report for activity of GIS Department.)

if more departments are involved in this single system. Under this situation, the system users are also the information providers for the system. Fully data sharing policy will significantly changes the status of decision-making process in the parish government.

Probably another level, between the public and the parish government, can be added into this framework. The system provides a shared geographic database for the public access. The system will help the developer to prepare submittal information. The developer can also trace the status of the process with the system as an additional way for the certification letter notice issued from the planning staff. On the other hand, the system can provide a solid foundation for the public to know what have happened and are happening in their community and to involve into the land use planning process. For example, the public can input their comments and feedback for the issues of their community through the on-line form in the webpage. The information can be maintained in the parish database. The result can be analyzed and reviewed by the decision-makers.



(Figure 15. Data flow chart for procedure under Web-based GIS implementation.)

## **Chapter 8. Conclusion**

### **Overview**

This thesis focuses on GIS implementation strategy in local government. It is the author's contention that there exists a gap between introducing a new technique, such as GIS, into an organization and the technique being truly accepted and used by organization members. For example, integrating spatial analysis with GIS technology has been well accepted as a future trend by GIS developers to enhance the analytical capability of GIS. Prevailing GIS vendors like to address the capability of spatial analysis of their new GIS products. On the other hand, GIS users in local government still use GIS merely as a tool for storing and managing geographic data. Performing spatial analysis is limited to basic functions, such as spatial querying and map overlay, provided in most GIS packages. Typically, where local government GIS planners buy and install sophisticated GIS packages, they find that potential users do not understand how to effectively utilize the system in their work. This is the case in Ascension Parish Government's GIS project. The author assumes that this situation is not limited to Ascension Parish, but a common situation in local government where a GIS is adopted. One reason is that local government often lacks well-trained people capable of employing advanced GIS functions. This situation poses a question to GIS planners: what can they do to improve the GIS usage if they want to capitalize on technical advances of GIS? Is there any solution for this problem beyond hiring new appropriately trained staff members?

Motivated by these questions, the following issues in GIS implementation are discussed in this thesis to help the GIS planners formulate an implementation strategy.



The first issue addressed in this thesis is about identifying the objective of GIS implementation. In Chapter 1, the objective of GIS implementation is defined as positive changes in decision-making behavior in local government brought by introducing GIS.

The second issue concerns setting goals to achieve the objective of implementation. In Chapter 3, by reviewing the efforts of GIS project in Ascension Parish Government, the author identifies the needs to improve both GIS data access and usage of GIS technology in supporting decision-making with GIS. Recognizing that societal issues play an important role in the acceptance and use of GIS in an organization, the author introduces a survey of GIS usage and interviews conducted with parish employees in Chapter 5. Analysis of the results of the survey and interviews indicates that certain issues, such as local government employees' attitude toward accepting new techniques and their personal decision-making style, are strong factors that affect the efforts of GIS planners in diffusing GIS technology.

The third issue is about the evaluation of GIS planners' efforts in system implementation. A three-level evaluation framework is established in the context of information process in local government. Using this framework to examine the changes in local government employees' operational decision-making, in managerial control, and in data flow pattern organizational structure brought by GIS implementation can help the GIS planners clarify the advantages and weakness of their implementation strategy and direct their future efforts.

Based on these three issues discussed in the thesis, the author proposes a new model of GIS implementation strategy, Web-based GIS. In Chapter 6, the concept of Web-based GIS implementation is introduced. An example of Web-based GIS application in the land development

application permitting process in the Planning Department of Ascension Parish Government is introduced and analyzed in Chapter 7. Web-based GIS, by combining GIS technology and Internet technology, can provide data access to a broader range of users, distribute flexible and user-oriented GIS applications to meet users' specific needs, and enhance the integration of GIS with other information systems, such as Land Information System (LIS) and CAD, that have been used in local government. The thesis concludes that Web-based GIS holds many opportunities to achieve a successful GIS implementation strategy.

### **Implementation Means Change**

GIS implementation is beyond buying the hardware, installing the software and network, and producing final GIS data products. Just as defined in Chapter 1, implementation means changes that take place in decision-making behavior in an organization where new techniques and systems are introduced. For the GIS planner, the job should focus on monitoring and evaluating these forces and using means to trigger positive changes. Keeping this in mind can help them focus their efforts in more productive direction.

### **Improving Use of GIS Brings Change**

Development of a successful implementation strategy requires that GIS planner have a comprehensive knowledge of technical issues in GIS and an in-depth understanding of potential users' real needs. In most cases, the latter is more important for GIS planners to develop a successful implementation strategy. In Chapter 5, the survey conducted in Ascension Parish Government displays that employees in some departments, where GIS has not been used intensively and parish data resources are not distributed in their departments, show strong interests in using GIS in their work. For

most local government employees, unawareness of GIS potential and uncertainty of using computer programs prevent them from accepting GIS as a useful tool in their work. The survey also shows that those employees who intentionally keep their own geographic data in the work are most likely to use GIS technology in their job. Interview with the manager of the Financial Department revealed managerial concern for GIS implementation in that department. For example, full data sharing in Web-based GIS implementation may not be a good idea for the manager of the Financial Department who assumes that public access to data may undermine the advantages of the department in controlling the data of potential rental sites of business value. All these findings indicate that user involvement and feedback are important for GIS planners to explore user requirements, identify potential areas for GIS utility and direct their implementation strategy.

In summary, the objective of GIS implementation is to bring changes in the decision-making process in local government. Changes in decision-making behavior brought by GIS can only occur in places where geographic data are intensively used. To enhance the use of GIS data and GIS technology, the GIS planners should focus their efforts on developing responsive applications to meet users' requirements. Only in this way, can such an implementation strategy encourage people to accept and use GIS technology in their work and further support the development of new tools that facilitate an improved decision-making process.

### **Data Flow Reveals Change**

To evaluate GIS implementation strategy in local government, the author establishes a three-level evaluation framework to monitor the changes on the level of local government employees' operational

decision-making, on the level of department manager's managerial control, and on the level of information process in organizational structure.

Monitoring data flow patterns in information processes is useful to identify how geographic data and other data are used and whether they are used wisely and efficiently. In Chapter 7, data flow analysis is applied on the process of land development application permit in Planning Department. Entities involved in this process, such as land developers, government agencies, engineers and the Parish Planning Commission, are treated as both data providers and users. Dimensions of data flow in the process can be clarified with data flow analysis. How data is controlled and affected by each entity can be evaluated. Results of such analysis can help the GIS planner to set up data share policies that enable the data to be used in an efficient way.

In the example cited in Chapter 4, regarding use of GIS in redistributing Parish Council boundaries, applying data flow analysis can also illustrate why conventional GIS implementation brings little change in decision-making behavior. The four entities involved can be identified as the Parish Council, the outside GIS consulting firm, the GIS Department and the general public. Three dimensions of data flow exist in this case. The first is between the Parish Council and outside GIS consulting firm, the second is between outside GIS consultant firm and GIS Department, and the third is between parish government and general public. The first dimension is the dominant one in which ideas exchange and data control are intensively performed. The GIS Department has limited capacity to affect the data flow in this case. Its job is to check the accuracy of the data. The general public is obviously the weakest link in this data flow pattern. They are just passive data receivers of the final result, and there is no evidence that they can affect the decision-making in this case.

In summary, data flow is the essential part of GIS implementation strategy. Reviewing the decision-making process from the perspective of data flow can clarify how decision-makers use data and how data will affect the decision-making. The three-level evaluation framework can help the GIS planner identify the problems in their implementation strategy, evaluate their efforts in implementation and set up a plan for their future efforts.

### **Opportunity in Web-based GIS**

If shifting from mainframe GIS to desktop GIS is a significant evolution of GIS technology in last century, then technical advances in Internet technology are reshaping today's GIS. The driving force is the rapid growth of requirements for geographic data. With the increased utility of Global Positioning System (GPS) technology in civil and commercial areas, obtaining accurate geographic data is easier and faster than before. The Internet can distribute the geographic data to a wider range of users efficiently and effectively. In addition, there is a need for more flexibility in GIS applications to meet people's particular requirements. Web-based GIS can be a desirable solution for distributing geographic data and developing specific GIS applications with a high degree of flexibility.

Land use planning is a decision-making process for local government to determine the future land use pattern in the community. The advantages of implementing GIS in land use planning have been discussed in Chapter 7. The example of Web-based GIS application in the land development permit process introduced in Chapter 7 reveals the potentials of Web-based GIS implementation to change the decision-making in land use planning.

First, Web-based GIS implementation improves access to geographic data for the decision-maker and other planning participants. Web-based GIS integrates the information process in local government

with a shared database. The decision-maker and other planning participants can have a comprehensive view of the community with the data provided by the shared database. Using flexible geo-processing tools provided by Web-based GIS, the decision-maker and other planning participants can obtain the answers to critical questions in planning process, such as how land use patterns are changing in the community. Planning process, such as land development application permits, can be facilitated with Web-based GIS implementation. A shared database eliminates data conflicts and improves the communication between the land developer and local government agencies.

Second, Web-based GIS implementation improves the data exploration for local government. For example, data flow analysis of the land development application permit process indicates the land developer can be a data provider for parish GIS database. The submittal documents required from the developer reflect real time land use patterns in the community. When this data is collected and stored in the database, it can be analyzed with other spatial analysis tools to identify trends of land use change and help planners evolve land use policies. Once the database is open to the public, businesses and individuals can use the data for their own specific objectives.

Third, Web-based GIS implementation enhances the public participation in the planning process. Implementing Web-based GIS enables individual citizens to know what has happened and what will happen in the community. Web-based GIS can also be used as a forum for citizens discussing critical planning issues that will affect their community. For example, by using digital forms on Web-based GIS to collect opinions of the public regarding planning issues, individual citizens can add their voices to the decision-making process. The general public will no longer be a "weakest link" in the planning process.

## **Summary**

Returning to the three-level evaluation framework, Web-based GIS improves access to geographic data for local government employees. With flexible user-oriented GIS tools on Web-based GIS, local government employees can focus on using geographic data in their work with minimal requirements for them to perform data conversion, geo-processing and programming. An appropriately designed, user-friendly interface can be readily developed in Web-based GIS, and this will encourage local government employees to accept and use Web-based GIS in their operational decision-making. For the manager of a specific department, his/her involvement in the designing process of Web-based GIS application can help him/her to have an in-depth understanding of Web-based GIS impacts on management of the department, and in turn use it to support the information management. The on-line monthly report used in GIS Department, introduced in Chapter 7, is one example of implementing Web-based GIS to improve management in the department. On the level of organizational structure, Web-based GIS enhances the integrity of the information management process throughout the local government. Sharing databases reduce data redundancy and data conflicts. The data flow pattern is more efficient. In addition, each data user is also a potential data provider for the shared database. With new information incorporated into the database, more new data layers can be added into GIS for creating meaningful maps for different purposes.

Finally, implementing Web-based GIS in local government provides a solid foundation for the public to participate in land use planning decision-making process. With Web-based GIS distributing geographic data and geo-process tools to the public, planning issues can be informed and discussed by

a broader range of audiences. Without this solid foundation, the potential for land use planning to protect land values and public interests cannot be guaranteed.



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## Appendix A: A Survey of GIS Technology Application of Parish Employees

1. What is the role of geographic information in your work?

- |  |     |    |             |
|--|-----|----|-------------|
| a) Very important                        | Yes | No | Do not know |
| b) My work needs geographic information. | Yes | No | Do not know |
| c) Needless                              | Yes | No | Do not know |

2. What kinds of geographic information are important for your job?

- |                                    |     |    |             |
|------------------------------------|-----|----|-------------|
| a) Aerial photograph.              | Yes | No | Do not know |
| b) Address                         | Yes | No | Do not know |
| c) Street map                      | Yes | No | Do not know |
| d) Parcel and subdivision boundary | Yes | No | Do not know |
| e) Flood plain                     | Yes | No | Do not know |
| g) Zoning and land use             | Yes | No | Do not know |

3. How do you get the geographic information in your work?

- |  |     |    |             |
|--|-----|----|-------------|
| a) Searching on the Parish local area network. | Yes | No | Do not know |
| b) Map or hard copy archives.                  | Yes | No | Do not know |
| c) Ask for someone else.                       | Yes | No | Do not know |

4. Do you maintain the geographic information you needed by yourself?

Yes	No	Do not know
-----	----	-------------

5. Do you update the geographic information maintained by yourself?

Yes	No	Do not know
-----	----	-------------

6. How do you use the geographic information in your job?

- |                      |     |    |             |
|----------------------|-----|----|-------------|
| a) Writing report.   | Yes | No | Do not know |
| b) Map presentation. | Yes | No | Do not know |
| c) Making schedule.  | Yes | No | Do not know |
| d) Others            | Yes | No | Do not know |

7. Do you know that there are on-line 'Parcel search', 'Street search', and 'Subdivision search' tools available on the Parish local area network?

Yes	No	Do not know
-----	----	-------------

8. Have you ever been using the 'Parcel search', 'Street search', and 'Subdivision search' on the Parish local area network?

Yes    No    Do not know

9. Are those tools efficient for searching information for your need?

Yes    No    Do not know

10. Do you have any problems when using those searching tools?

Yes    No    Do not know

11. What improvement of the on-line geographic information can be on the Parish local network?

---

12. Have you ever been using the Geographic information System (GIS) before?

Yes    No    Do not know

13. Do you think using GIS can improve your performance in your job?

Yes    No    Do not know

14. What kinds of GI would you like to see, but currently do not have access to?

15. Are you interested in the training program in GIS system provided by the Parish?

Yes    No    Do not know

16. How long have you been working for the Parish Government? \_\_\_\_\_ Years.

17. What department are you currently working for? \_\_\_\_\_.

The survey is available on [http://ascension.par.la.gov/dev/under\\_construction/gis/gis\\_survey.asp](http://ascension.par.la.gov/dev/under_construction/gis/gis_survey.asp)

The result of survey:

```
"ID" ,  
"Q1_ A" , "Q1_ B" , "Q1_ C" ,  
"Q2_ A" , "Q2_ B" , "Q2_ C" , "Q2_ D" , "Q2_ E" , "Q2_ F" ,  
"Q3_ A" , "Q3_ B" , "Q3_ C" ,  
"Q4 " , "Q5 " ,  
"Q6_ A" , "Q6_ B" , "Q6_ C" , "Q6_ D" , "Q6_ " ,  
"Q7 " , "Q8 " , "Q9 " , "Q10 " ,  
"Q11 " ,
```

"Q12 ", "Q13 ",  
 "Q14 ",  
 "Q15 ", "Q16 ", "Q17 "

5,  
 "N", "Y", "N",  
 "D", "D", "D", "D", "D", "D",  
 "Y", "N", "Y",  
 "N", "N",  
 "N", "N", "N", "N", "",  
 "Y", "Y", "Y", "N",  
 "None. Keep up the good work.",  
 "Y", "D",  
 "I can get all I need.",  
 "Y", "2", "Technology"

6,  
 "N", "Y", "N",  
 "N", "N", "N", "N", "N", "N",  
 "N", "N", "N",  
 "Y", "Y",  
 "Y", "Y", "N", "", "Writing grants",  
 "N", "N", "D", "",  
 "",  
 "N", "D",  
 "",  
 "", "7", "Mental Health/Substance Abuse"

7,  
 "", "Y", "",  
 "Y", "Y", "Y", "N", "N", "Y",  
 "Y", "Y", "N",  
 "N", "Y",  
 "Y", "Y", "Y", "Y", "Jut as a quick answer for this survey, I think the",  
 "N", "N", "D", "D",  
 "",  
 "Y", "Y",  
 "",  
 "Y", "7", "Recreation"

8,  
 "N", "N", "N",  
 "N", "N", "N", "N", "N", "N",  
 "", "", "",  
 "", "",  
 "", "", "", "", "",  
 "N", "N", "", "",  
 "",  
 "D", "",  
 "",  
 "D", "2", "Finance"

9,  
 "Y", "", "",  
 "Y", "Y", "Y", "Y", "", "",  
 "Y", "Y", "Y",  
 "Y", "Y",  
 "", "", "", "Y", "To answer inquiries from public.",

"Y", "N", "D", "D",  
 "",  
 "Y", "Y",  
 "",  
 "Y", "7.5", "Secretary"

10,  
 "Y", "Y", "N",  
 "Y", "Y", "Y", "Y", "Y", "Y",  
 "Y", "Y", "N",  
 "N", "D",  
 "", "", "", "Y", "",  
 "Y", "Y", "Y", "",  
 "",  
 "Y", "Y",  
 "",  
 "Y", "8", "Drainage dept. @ DPW"

11,  
 "", "D", "",  
 "N", "Y", "Y", "N", "N", "N",  
 "D", "N", "N",  
 "N", "D",  
 "D", "D", "D", "N", "",  
 "N", "N", "D", "D",  
 "none that I'm aware of.",  
 "N", "D",  
 "N/A",  
 "D", "7", "AP Jail"

13,  
 "Y", "", "",  
 "Y", "Y", "Y", "Y", "Y", "",  
 "Y", "", "",  
 "Y", "",  
 "", "", "", "Y", "For reviewing proposed subdivision Plats",  
 "Y", "Y", "Y", "N",  
 "",  
 "Y", "Y",  
 "Flood Plain Overlays",  
 "Y", "4.5", "Planning"

14,  
 "Y", "", "",  
 "Y", "Y", "Y", "Y", "N", "N",  
 "Y", "Y", "Y",  
 "N", "Y",  
 "N", "N", "Y", "Y", "To determine if an address is in a subdivision for",  
 "Y", "Y", "Y", "N",  
 "",  
 "N", "D",  
 "",  
 "Y", "5", "Road & Bridge Dept & Weed Control"

15,  
 "", "Y", "",  
 "Y", "Y", "Y", "Y", "Y", "Y",  
 "N", "N", "Y",

"N","D",  
 "Y","Y","N","Y","Demonstrative Evidence. ",  
 "N","N","Y","D",  
 "I would just need some training on how to use it. ",  
 "N","Y",  
 "Not sure what all is currently available so I can'",  
 "Y","6","Legal"

18,  
 "Y","Y","N",  
 "Y","Y","Y","Y","Y","Y",  
 "","Y","",  
 "N","Y",  
 "","Y","N","",  
 "Y","N","", "D",  
 " ",  
 "Y","",  
 " ",  
 "Y","3","Planing & Developmet"

19,  
 "","Y","",  
 "N","N","N","N","N","N",  
 "N","N","N",  
 "N","N",  
 "N","N","N","N","",  
 "N","N","D","N",  
 " ",  
 "N","D",  
 " ",  
 "D","25","HUMAN RESOURCES"

20,  
 "Y","",  
 "Y","Y","Y","Y","Y","",  
 "Y","",  
 "Y","Y",  
 "Y","Y","", "Y","setting up off system bridges and updating the inf",  
 "Y","Y","Y","N",  
 " ",  
 "N","Y",  
 " ",  
 "","10","engineering"

26,  
 "N","Y","N",  
 "N","Y","N","N","N","N",  
 "Y","Y","Y",  
 "N","N",  
 "N","N","N","Y","To notify job applicants and other people outside of Parish Gov't that  
 the technology exists. Also used to check boundaries for Council districts.",  
 "N","N","D","D",  
 " ",  
 "Y","Y",  
 " ",  
 "D","2","Human Resources"

27,

"Y","Y","N",  
 "Y","Y","Y","N","Y","Y",  
 "N","Y","Y",  
 "N","Y",  
 "N","Y","N","Y","Emergency Telephone Alerting System  
 Location of Critical Facilities",  
 "N","N","D","D",  
 "Include the Cities of Gonzales and Donaldsonville, and the Town of Sorrento",  
 "Y","Y",  
 "Floodplain/FIRM Repetitivly flooded areas",  
 "Y","13","Office of Emergency Preparedness"

28,  
 "","Y","",  
 "Y","Y","", "Y","Y","Y",  
 "D","Y","Y",  
 "D","Y",  
 "Y","Y","Y","Y","To include in the packages for Planning and Zoning Commission Members",  
 "Y","Y","D","D",  
 "",  
 "D","D",  
 "",  
 "Y","8","Zoning"

29,  
 "","Y","",  
 "","Y","Y","", "Y","Y",  
 "Y","Y","Y",  
 "N","Y",  
 "N","N","N","Y","IN ISSUNG BUILDING PERMITS WE NEED FLOOD ZONE DETERMINATIONS AND LAND  
 USAGE, LAND USAGE FOR COMMERCIAL JOBS.",  
 "Y","Y","Y","N",  
 "",  
 "Y","Y",  
 "",  
 "N","11","BUILDING"

30,  
 "Y","", "",  
 "Y","Y","Y","Y","Y","Y",  
 "","","Y",  
 "N","Y",  
 "Y","Y","D","Y","Will assist in preparing special upcoming projects w/HM scheduled for  
 next 6 months. What does "making schedules" mean - I'm sure it is not setting meetings  
 for HM!",  
 "Y","Y","Y","Y",  
 "Something like an index - or more importantly ,maybe I just need more practice and/or a  
 class on it all because I get bits and pieces here and there and do not feel confident as  
 of yet to 'just go directly to what I need at the time'.",  
 "Y","Y",  
 "Any and all - but need an 'address directory' or class to get it all down.",  
 "Y","2.5","President's Office"

31,  
 "","Y","",  
 "Y","Y","Y","Y","Y","Y",  
 "Y","Y","Y",  
 "N","D",

"Y","Y","Y","","",  
 "Y","Y","Y","N",  
 "",  
 "Y","Y",  
 "Tracking of vehicles",  
 "D","2.1","Building Department","",

33,  
 "Y","","",  
 "Y","","","","",  
 "Y","Y","",  
 "N","N",  
 "", "Y","","Y","public information source within the framework of recreational  
 availability for the parish.",  
 "Y","Y","Y","N",  
 "",  
 "Y","Y",  
 "",  
 "Y","1.5","recreation"

34,  
 "", "Y","",  
 "Y","N","Y","N","Y","Y",  
 "Y","Y","Y",  
 "N","N",  
 "Y","N","N","Y","",  
 "N","N","N","D",  
 "",  
 "N","D",  
 "",  
 "Y","2","legal"

35,  
 "Y","Y","Y",  
 "", "Y","Y","Y","Y","Y",  
 "Y","Y","N",  
 "Y","Y",  
 "Y","Y","N","Y","",  
 "Y","Y","Y","N",  
 "",  
 "Y","Y",  
 "",  
 "Y","8","Planning and Development"

36,  
 "Y","Y","N",  
 "N","N","Y","Y","Y",  
 "Y","N","Y",  
 "N","Y",  
 "N","Y","Y","N","",  
 "Y","Y","Y","Y",  
 "can't think of any",  
 "N","Y",  
 "current dpw projects in progress and those completed",  
 "Y","2","parish president's office"

37,  
 "Y","D","D",



```

"Y","Y","Y","Y","Y","Y",
"Y","Y","D",
"Y","Y",
"Y","D","D","Y","Location for addressing, new roads, owner of property, also for zoning
purposes when there is more than 1 resident on the property.This is a very useful
program.",
"Y","Y","Y","N",
" ",
"Y","Y",
" ",
"Y","6","Planning and Zoning"

38,
"Y"," "," ",
"Y","N","Y","Y","N","N",
"Y","Y","Y",
"Y","Y",
"Y","N","N"," "," ",
"Y","Y","Y","Y",
" ",
"N","Y",
" ",
"Y","1.3","DPW"

40,
"D","D","D",
"D","D","D","D","D","D",
"D","D","D",
"D","D",
"D","D","D","D"," ",
"Y","Y","D","N",
" ",
"N","N",
" ","N","finance"

42,
"Y"," "," ",
"Y","Y","Y","Y","Y","Y",
" "," ",
"Y","N",
"D","Y","Y"," ","Y","projects",
"D","N","D","D",
"We are not currently able to access the Parish Local Network.
Would be great if we could.",
"N","Y",
"We have NO ACCESS",
"Y","2.5","Maintenance"

44,
"N","N","Y",
"N","N","N","N","N","N",
"D","D","D",
"N","D",
"D","D","D","D"," ",
"Y","Y","Y","N",
"Parcel Search - needs to be updated...",
"N","D",
" ","N","13","Finance"

```

46,  
"N","Y","Y",  
"N","Y","N","N","N","N",  
"N","N","N",  
"N","D",  
"D","D","D","D","",  
"N","N","D","D",  
",",  
"N","D",  
",",  
"D","3","Mental Health"

47,  
"Y","",",  
"Y","Y","Y","Y","Y","Y",  
",",",",",  
"N","D",  
"Y","Y","",",",  
"N","N","D","D",  
"We need to have access to this program.",  
"N","D",  
"ALL",  
"Y","4.75","Maintenance"

48,  
"D","Y","N",  
"N","Y","N","N","N","N",  
"Y","Y","Y",  
"D","D",  
"N","N","N","D","",  
"Y","Y","Y","N",  
",",  
"Y","D",  
",",  
"D","2","President's Office"

50,  
"Y","Y","N",  
"Y","Y","Y","D","D","D",  
"Y","Y","Y",  
"Y","Y",  
"Y","Y","",",",  
"The Health and Social Services would find geographic information very useful to continue to update the location of the different churches in the Parish of Ascension. It could be used as a service to the taxpayer, employees, constituents and/or others, with information or directions they may find useful. Also, for our personal use. I need help in keeping the information current. Classes would be useful.",  
"Y","Y","Y","Y",  
"A demonstration was done in the office by the GIS person in reference to the Parcel & Street search. Would like to learn more about the searching tools. Improvements, made easy. It could improve work performance. Also, an organizational instruction diagram, of the steps on how to arrive to different locations.",  
"Y","Y",  
"Organizational charts of the Parish organization with the different departments and the chain of command. 2. An updated directory of information on all the employees, e-mail addresses, telephone numbers, job titles, and department locations. 3. An updated routing system and procedures of each department.",  
"Y","8","Health and Social Services Department"

51,  
 "Y", "", "",  
 "Y", "", "Y", "N", "Y", "Y",  
 "D", "Y", "Y",  
 "N", "Y",  
 "Y", "Y", "Y", "Y", "Economic development consulting",  
 "N", "N", "D", "D",  
 "Better access",  
 "Y", "Y",  
 "Base elevations", "Y", "contractor"

52,  
 "Y", "", "",  
 "Y", "Y", "Y", "Y", "N", "Y",  
 "Y", "Y", "N",  
 "N", "Y",  
 "Y", "Y", "N", "N", "",  
 "Y", "Y", "Y", "Y",  
 "",  
 "Y", "Y",  
 "",  
 "Y", "2", "Parish President Office"

53,  
 "Y", "", "",  
 "Y", "Y", "Y", "Y", "Y", "Y",  
 "Y", "Y", "",  
 "N", "Y",  
 "", "", "", "Y", "To check the flood zones, as well as wetlands, concerning parish ditches,  
 Canals, and Bayous, for day to day projects.",  
 "Y", "Y", "Y", "Y",  
 "An updated 'Parcel search' Map, showing new property owners.  
 I would also like to have the names of the Parcel owners printed out automatically,  
 together with Lot #'s. And 'Genie' if I get a third wish, I would appreciate a tool bar  
 like Paint Shop Pro 6, for the Parcel Maps. ",  
 "Y", "Y",  
 "",  
 "Y", "8", "DPW (Right-of-Way)"

54,  
 "N", "Y", "N",  
 "D", "Y", "Y", "D", "D", "D",  
 "N", "Y", "Y",  
 "N", "N",  
 "N", "N", "N", "Y", "Project location information kept in project file with invoices paid.",  
 "N", "N", "D", "D",  
 "",  
 "N", "Y",  
 "",  
 "D", "1", "Finance"

55,  
 "N", "N", "Y",  
 "N", "N", "N", "N", "N", "N",  
 "N", "N", "N",  
 "N", "D",  
 "N", "N", "N", "N", "",

```

"N","N","D","D",
",
"N","N",
",
"N","2.5","Mental Health"

56,
", "Y", "",
", "Y", "D", "", "", "",
", "", "Y",
"Y", "D",
", "", "", "D", "I issue permits in the Donaldsonville area.",
"D", "N", "D", "D",
",
"N", "",
"Map of streets in the Parish (Donaldsonville Area)",
", "3", "Parish President's Office-South"

```

## **Appendix B: Ascension Parish Planning Commission Preliminary Subdivision Plat Review Checklist**

Subdivision Name: \_\_\_\_\_

Developer: \_\_\_\_\_

Engineer/Land Surveyor: \_\_\_\_\_

Date Received: \_\_\_\_\_ Date Reviewed: \_\_\_\_\_

\_\_\_\_\_ Adequate      \_\_\_\_\_ Inadequate, Incomplete, Omitted

THE FOLLOWING INFORMATION SHALL BE INCLUDED ON THE PRELIMINARY PLAN:

\_\_\_\_\_ 1. Title-

Name of Subdivision \_\_\_\_\_

Name of Developer/Owner \_\_\_\_\_

Location of Property \_\_\_\_\_

Name of Engineer/Land Surveyor \_\_\_\_\_

\_\_\_\_\_ 2. Boundary Lines and Existing Improvement-

Boundaries of Subdivision Location \_\_\_\_\_

Names & Widths (R/W & Pavement) of Adjoining Streets

\_\_\_\_\_ Section and Township Line \_\_\_\_\_

Incorporates Areas \_\_\_\_\_

Sewer Districts \_\_\_\_\_

Zoning Districts \_\_\_\_\_

School Districts \_\_\_\_\_

\_\_\_\_\_ 3. Adjoining Property-

Name of Adjoining Subdivision \_\_\_\_\_

Name, Addresses & Record Owners of Subdivided Property \_\_\_\_\_

Adjoining Lots and Streets \_\_\_\_\_

Adjoining Property Owners Form \_\_\_\_\_

\_\_\_\_\_ 4. Features of Proposed Subdivision-

Proposed Location, Names and widths of streets \_\_\_\_\_

Layout & Approximate Lot Dimensions \_\_\_\_\_

Other Necessary Description of Lots & Servitudes \_\_\_\_\_  
Location & Dimension of Existing Building \_\_\_\_\_  
Front Building Lines \_\_\_\_\_

- \_\_\_\_ 5. Drainage Ditches –  
Existing Drainage Ditches \_\_\_\_\_  
Drainage Ditches From Proposed Subdivision to Ultimate Drainage Channel \_\_\_\_\_  
Contour Map Where Terrain May Affect Location of Ditches \_\_\_\_\_
- \_\_\_\_ 6. Streets-  
Statement of proposed Street Improvements \_\_\_\_\_  
Contour map where terrain may affect location of streets \_\_\_\_\_
- \_\_\_\_ 7. Special Use Areas –  
Location and Size of Proposed parks, Playgrounds, Church or school Sites or Other Special  
Land Uses \_\_\_\_\_
- \_\_\_\_ 8. North Point, Scale and Date \_\_\_\_\_
- \_\_\_\_ 9. Vicinity Map –  
Vicinity Map at 2000' Scale for Subdivisions of More than 20 Lots \_\_\_\_\_  
Vicinity Map at 500' Scale for Subdivision of Less than 20 Lots \_\_\_\_\_
- \_\_\_\_ 10. F.E.M.A. Flood Plane Delineation and Designation and Inundation/100 Year Flood  
Elevation \_\_\_\_\_
- \_\_\_\_ 11. Wetland Determination \_\_\_\_\_
- \_\_\_\_ 12 General Information Describing Existing Conditions of Site –  
Existing Covenants \_\_\_\_\_  
Land Characteristics \_\_\_\_\_  
Available Community Facilities and Utilities \_\_\_\_\_  
Number of lots \_\_\_\_\_  
Typical Lot Width and Depth \_\_\_\_\_  
Park Area and Other Public Areas \_\_\_\_\_  
Proposed utilities \_\_\_\_\_  
Proposed Street Improvements \_\_\_\_\_

COMMENTS: \_\_\_\_\_  
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## **VITA**

Hongwei Zhao was born on November 3, 1972 in ShanXi, People's Republic of China. He got his bachelor's degree in architecture in 1994, Southeast University, Nanjing, People's Republic of China. Since August 1999 to May 2002, he pursued his master's degree in the School of Architecture, Louisiana State University.