

Development of city water supply net information system

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Abstract: Through analyzing the present conditions of water supply networks technical administration files in Chongqing, this paper points out the significance and urgency for exploiting advanced water supply networks information system. It also gives the concept of GIS and some suggestions for the exploitation.

Keywords: city water supply; water supply networks information system; Geographical Information System (GIS)

1 General situation

Along with the speedup of the global urbanism, the increase of the world population and the environment turning worse, protecting the ecosystem environment and realizing sustain development have already become an important strategy problem that the seven seas pay attention to. The sixteenth session of Chinese communist bring up completely the strategy target of developing middle- class society, insist large, moderate and small cities to harmonize the development with small towns, program scientifically, and make a point of developments, enhance the management, and strengthen the town economy, perfect town function, expand town civilization. The government of Chongqing also points out the development targets that construct Chongqing to be a modern metropolis of a center, many regiment and town cluster. Until 2005, the rate of becoming the whole town attains 41%, catching up the national average level; until 2010, the rate attains 50%. There are two rivers — Yangtze River and Jialing River around Chongqing. Water resources are rich, and the amount of supply water is ample. Because of the geography with the history reason, the supply water system of Chongqing is constituted primarily by public water supply system and self- provided water factory of numerous enterprise, mainly take the water from Yangtze River and Jialing River, 720 ten thousand stere daily. The public water supply system is divided into two parts: One is public water supply system of the city zone whose principal part is municipal water supply company, which own 9 water factories, 14 water supply establishment, the supply water ability is 103.5 ten thousand stere daily (additional 20 ten thousand stere water supply system

is setting up). The other is 99 sets borough (city), county and town public water supply system, the supply water ability is 43 ten thousand stere daily. The self- provided water supply system of enterprises possess 234 sets totally, the daily supply water ability is 278 ten thousand stere. In addition, Chongqing Power Plant wholly offer 300 ten thousand stere water supply facilities that cool off the water [1] for its generate electricity equipments. Many self- provided water factories of enterprise make up the defect that professional waterworks are too far away to be able to help, and have outstanding social benefits because of their large quantity and wide distributing area. But the condition that so many water supply units exist side by side and separate from each other cause the water supply networks technical administration files in Chongqing to have some other problems besides some widespread problems that other cities still exist, the main performance is as follows:

1.1 The lack of the cognition of water supply networks technical administration files

To many people, the cognition of city water supply networks technique administration files usually just rest on the data's collection, tidying up and conservation, but pay no attention to the effect on decreasing energy consume, saving funds, optimizing decision- making etc. Moreover, some water supply units merely manage local networks technical files, less consider the importance of water supply networks technique administration files from the point of view of the whole city.

1.2 Unbalance of management level

The gaps between self- provided water factory and

profession water works embody the following aspects: the special technical personnel potency, the exploitation of specialty and calculator technique combined together and the regard extent. As a result, water supply networks technique administration files sometimes was influenced. At a certain extent, such status certainly will impact the development of the whole city's water supply networks technique administration files.

1.3 The management means hang behind

The collection, sorting, identification, keeping and statistics of the water supply net technique data in some units are still completely handwork, which is not only trivial and tedious, but also less dependable. For example, making use of laggard means such as the drawing to record various primitive notes seems not only be in confusion, but also deform and lose easily, even more make against the synthesis and utilization of whole city water supply nets' data.

1.4 The files couldn't reflect the realistic circumstance completely

Because Chongqing climate is broad and water supply nets distribute widely, it is hardly to guaranty that daily alteration be on record fully and report to the programming department and other city water supply net administration files department. Accordingly, it will influence all levels manage section control the realistic data in time, whose value in use, reference and manage should be restricted.

As the literature that history recorded, tidied up and come down, city water supply net technique file have functions of scientific manage, science research to continue, use for reference, iterant utilization, technique attorn and transfer, history using and so on. If there is no accurate and thorough files of water supply net, we can't comprehensive evaluate the whole net, can't accurate estimate the nets' running state, and cannot find exactly reason that the nets go wrong. Therefore, the pertinence of adopted technical measure that guarantee the nets run safely is not enough good [2]. Manage also can't carry through upon the economical and efficient basic. But accurate and thorough files demand modern manages, advanced scientific technique, especially a support of calculator technique. Chongqing is an old industry base, underground water networks interleave vertically and

horizontally. Unless realizing modernization of the water supply net technique file, standard manage as early as possible, along with the temporal process, complicated underground nets will become more and more huge, running and management will become more and more difficult, the cross contradiction with underground various engineering establishment will gradually outstanding, finally obstruct the city's development. Therefore, for the sake of using limited funds to solve the running difficulty of the old system and the reasonable development of the new system, giving attention to both the near period benefit and the long-term benefit, and greeting Chongqing new development opportunity, it is urgent to establish the modern water supply net information manage system.

2 GIS and water supply net information system

2.1 GIS

GIS is namely Geography formation System. It was published in the late 60 age of 20 century. But until 90 age, along with calculators, communication network and information science technique develop quickly, new technique continuously come forth, the apply and research of GIS widely go deep into society, economy, politics, military affairs, engineering each fields of etc related on geography space problems. Relative to other countries, the application of GIS commences later. GIS is an outcome of calculator science and the ground science combined together, and is a management information system based on the map. The GIS technique primarily includes two software techniques — database management system(DBMS) and computer aided design(CAD), with special function to manage and analyze the space data. The functions of DBMS and CAD are that they can adopt numeric form, collect and manage geography element and their attribute data; moreover they can define their space relation definitely by set up top connection. The graphics user interface (GUI) admits user show and operate data on visible map, whose handle fashion of information is graphics mode. It is straight and hilight, the distributing of geography factor and the top connection between each other are clear at a glance. The special function that GIS provides can be used to process measure, switch coordinate, create image, modify attribute, establish new object, make curve to be flatness, statistical analyze, top pile up, topography

surface operate and network analyze etc. Moreover many products of GIS still provide the mighty macro language AML, the customers can program by oneself conveniently, and it can attain the aim that enlarge the system function [3].

2.2 Water supply net information system

GIS' own special space analysis function and visible expression manner just accord with water supply net information, which has characteristics in strong in regions, concealment, complicity, the dynamic, data with great quantity. City water supply net information system is a technical system that make use of the geography information system (GIS) etc. calculator techniques and water supply technique to collect, manage, renew, synthesize, analyze and handle the city water pipe-line information. Generally, there are two kinds of data — graphics database and attribute databases saving in the GIS water supply net manage system. The graphics database deposit the pixel of the relief map and water net map, and usually street map is used to be the base map of the relief map, water pipe and water net establishment is used to be the pixel on the map. The relief map layer' s information is great, density is big, graphics is complex, and its action is mostly backdrop consult, which can be recorded into the relief map by scan. The water pipeline and the establishments on the water net map may be recorded into the relief map by numeric manner. Relief map, pipeline, net establishment such as brake valve, water meter and hydrant are set on different layers. In practice, we can operate each layer separately or add some layer together to operate and analyze. Attribute database can deposit and describe the water net with the establishment attribute, and can make use of the database that belong to GIS software system or transfer other exterior database (such as foxpro) to be graphics pixel' s attribute database to save attribute data such as the serial number, model number, purpose and lay age. By the internal code and the customer identification code as the public field, the graphics database and attribute database are connected together, making attribute data describing pixels and relevant pixels establish corresponding connection one by one. Accordingly, it can realize graphics and attribute data inquire about one another. Meanwhile, graphics edit, data statistics, net leak hunting etc become accurate, quick and convenient.

3 Exploitation train of thought

City water supply net information system is a technique system that use geography information system (GIS) etc. calculator technique, water supply and other special technique to collect, manage, renew, synthesize, analysis with handle the city water pipe line information. GIS primarily include the database manage system (DBMS) and the computer aided design (CAD), which both have mighty software technique. The main performance of their function is that they can adopt numeric manner to collect and manage the geography element with its attribute data, and definitely define their space contact by top connection. The graphics and data (such as pipe type, length, material, lay age, belong to unit, ubiety road etc.) of GIS may call on each other, namely lookup corresponding data and graphics through graphics. Graphics and data may display on the same screen, query, increase, deletion, modification etc. become direct, convenient. And CAD has read- Write database' s connection module, which offer the possibility for the links between graphics and attribute data. As newly arisen edge knowledge, GIS gather computer science, geography, mapping and remote sensing science, environment science, city science, space science, manage science and related courses together. Its application in the water supply system, not only rest on managing water net commonly as a graphics database, but also can make use of mighty GIS analysis, simulation and prediction etc., combined with the profession theories and methods together to proceed the depth exploitation, offer decision-making support for programming and designing net, building and construction, every moving kinds of optimization attemperation and rush to repair trouble [4].

Now, many experts have already made a lot of research on applying the calculator technique to the water supply net file management. Some cities also have established the water supply net graphics information management system, and summarized plenty of precious and actual operation experience. For example: Shenzhen water supply company and Nanking science and engineering university together exploit “ city supply water net calculator graphics management system”, which has the information manage function of the data information, geography graphics, net graphics and net database, can provide net

condition, hydraulic analysis and calculating theories with the methods, and practical aided drawing tools, have artifices to put net graphics together and change scale, too [5]; faculty of sanitary engineering, Tientsin University, based on the Citystar of Beijing University and the MAPGIS of Chinese geology university for software exploitation successively, establishes the city water supply net manage system, and can input, modify and output water supply net graphics and attribute data by computer; proceed attribute query, space orientation and qualitative, quantitative statistics, analyze on pipe-line and every kinds of facilities space; and provide cutting- brake project and relevant information for repair of pipes' burst or leaking trouble and servicing[6]. Because it is costly and long- term operational that establish a water supply net information systems engineering in big cities, which have data existing, manage dynamic, apply extensive, contents thorough. After drawing lessons from the other cities' successful experience, we shall make sure our own concrete target and according to the term that we have possessed, choose scientific the reasonable project and work mode.

3.1 The practical project that the supervisor sections unify the deploy and each water supply unit partly responsible

Because Chongqing's water supply nets were built early, the topography is complex and changeable; it is impossible to complete the water supply net to set up the files by computer in the short period. As the range is concerned, this work involves many water supply enterprises and relevant organizations and parties all over the city; as the technique is concerned, it need advanced special knowledge on computer and other relevant knowledge combined well; as the practice is concerned, because each enterprise's technical potency and the degree of recognition is in disequilibrium, it is hard to ensure they carry into execution in the light of uniform technical require and plan. Therefore this is a system engineering that the synthesis and the technique are very good, requiring a scientific decision-making and an authoritative leader to unify management and organize to put in practice. The organism combination that leading of the organization come unifying management with, combining unified deployment and dividing the work but cooperation well. The leader program generally, display concrete assignment to the affiliated enterprises, send special technician and supervisor, unify technical means and criterions and

provide technical supports and consultation; each enterprises answer for the local water supply net information system's exploitation under the guidance of the leader and the assistance of the special reconnaissance units. Finally, the whole water supply net technique information files are united; complicated questions such as the join between sections are to be solved. Consequently, the whole water supply net information system will establish by stages and step by step.

3.2 Realize " the exterior reconnaissance, the interior drawing and the establishment of information system" integral

In the course of establishing the city water supply net information system, we should make the most of the existing information of water supply enterprise, based on the current drawing, organize profession troops to open the well to investigate and ascertain with instrument, mapping with resolution and draw with computer to obtain eh pipe line data achievement; according to the uniform format, files are founded at a time and synchronously establish the water supply net information system. In order to ensure the exercise's efficient and credibility, it is necessary to compare the apparatus and software of every company, then select advanced parse mapping tools and develop a suit of suitable software system; in addition, because the involved range is large in the course of the erection, it need a lot of manpower and financing. For the sake of avoiding blindness, we shall trial partly, evaluate every aspect, choose economical and efficient technical projects to extend. Meanwhile, it is necessary to establish engineering supervisor group constituted by special reconnaissance unit, establishing database unit, files management branch and relevant professionals, guaranteeing all target to come to a realization, actualize the procedure and tache technical supervisal and quality control. It is also necessary to organize the related personnel on file and water supply technique etc. to understand and learn net files management work and train directionally calculator information technique and exploitation. At the possibility of circumstance, the surveying of water supply net should be combined fully with other profession pipe survey, establish the city synthetical net information system to realize the resources share, provide the technique and decision-making support with water supply and other profession.

3.3 Exploitation of calculator integrate applied technique

Water supply net information system not only regard GIS as the core, realize automatic creation and analysis of the arbitrary water pipe line cross section, pipe engineering assistant design and pipe map synthesis etc. application and exploitation, but also integrate OA (Office Automation), network technique to provide supports for the programming synthesis and the net information share. Because the format of the document data is inconsistent with the pip-line graphics data in the examined pipe-line engineering data, its establishing tool is too different with it, the deposit of data is also in the different servers, the data can establish and save in the system of large database management by OA. Via the joint to office automation system, water supply net information system makes use of the network supporting and the technique of open database connectivity (ODBC) to realize the document query on the programming synthesis and programming examination and approval of the pip-line engineering. Meanwhile, all levels water supply net information systems will manage jointly through networks. All levels section can share the information, and can exchange the information at any time, renew the resources on time. The construction enterprise with other customers can expediently inquire about through Internet to obtain necessary information.

3.4 Realize the dynamic management of city water supply net

Water supply net information system is a dynamic information resource. In the process of the system establishing, the pipeline engineering that some have been already granted, setting up, or not setting up, or not yet finish still exist. It needs to import the sanctified engineering into the computer through constitute programming and examination database. Until the work is finished, the data will be deleted automatically and the data measured in the last will be edited into the system at the same time. Moreover, along with the city scale extend continuously, for the sake of the city's development demand, new underground pipeline will increase constantly, the original that is not adapt to the demand will be abandoned or replaced. If the water supply net information resources are not renewed on time, it still can't reflect the present condition of the water supply net. Therefore, we will carry through the engineering

checkup system strictly, ensure the water pipe line engineering be authorized before construction, and proceed finish measure before lay the pipes, renewing present condition information database in time, guaranteeing the water supply net information system is timely and accurate.

4 Tags

Making use of the calculator technique to establish the water supply net information system can make some operation such as input, output, modification, copy, search, transfer become simple, convenient, quick, overcome the lack of drawing manage, and the system has been a essential condition to realize modern, standard water supply net file management. Now the west is opening up greatly, if not use the calculator technique to establish the information system to proceed modern and standard management, the huge water pipe net system of Chongqing will not only increase constantly the expenses on water supply, and increase the cost of the city infrastructure, but also cause people's life inconvenient, finally baffle the development of Chongqing. It is imperative under the situation to realize the calculator management of the water supply net, but it is a complex system engineer involved many aspects, arrangement and various subject in the process, guaranteeing its current trend and accuracy, realizing dynamic management will also be a formidable task. It need improve people's recognition of the importance and water supply technicians' integrative diathesis particularly calculator technique level, even more argue, summarize and innovate continuously in the fulfillment.

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