A PRACTICAL METHOD TO COLLECT DATA FOR URBAN GIS

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ABSTRACT

In this paper, we explore a method to collect spatial data and attribute data for urban geographic information system, including the set of data classification and coding standard adapted to all users, and the solution of some key problems araised during the process to translate data between AutoCAD, ARC/INFO and MapInfo software. This method is suitable to the condition of China, and it has theoretical significant and practical value.

1 INTRODUCTION

With the development of computer technology in China, a total update from manual to computer assisted mapping has been completed in field of surveying and mapping since the end of 1980's. In the process of computer assisted mapping, AutoCAD software has been used to digitize various maps including topographic maps, pipe maps etc. The digital map, which was produced as AutoCAD's dwg file format, have been used by many sectors like urban planning and urban construction sectors.

From the 90th,many large cities in China tried to study and establish urban GIS. As the sectors of surveying and mapping are the largest producers of spatial data, in order to make a spatial location base for the urban GIS, they started to establish the spatial database for the urban GIS firstly. In the meantime, they also started to capture some basic common attribute information for the spatial database base on the annotation of the topographic map. Actually, sectors of surveying and mapping are undergoing major changes in their role from paper map factories to managers of digital spatial data.

The spatial database of urban GIS include control points, architects, roads, rivers, contours and pipes etc. In order to make the spatial database and its attribute information meet all demands of users, at present time in China, there exist two key problems in the process of data collection.

The first one is to set up the data classification and coding standard and to define the content of the basic attributions for spatial data. Because there are not yet a national data classification and coding standard for urban GIS in China, local standard for individual cities have to be set firstly to make sure the sharing of spatial data between different sectors and avoid duplicated work. And if need in future, the standard could be translated to the national standard.

The second one is about the translation between different data formats. In recent years, the

software industry in China has experienced a rapid growth, However, it should be noted that the development of software industry in China is far below the level that it deserves. Imported software packages are still the dominating force on the domestic markets. The establishment of both urban GIS database and users' GIS will select mature GIS software as the supporter. We found that ARC/INFO is the first-selected GIS software platform in China, the next is MapInfo, MGE etc. If we can translate all the dwg files produced in AutoCAD system during the past ten years into ARC/INFO and MapInfo platform successfully, we could meet all the demands for the data of all users and avoid doing duplicated work of data collection for above different 3 software systems.

Nanjing city is one of the large cities that started urban GIS research earlier in China. Like many other cities, its sectors of surveying and mapping used AutoCAD software for computer assisted mapping in the past years, 2 kinds of software, ARC/INFO and MapInfo were selected to establish its urban GIS.A practical method how to collect spatial and attribute data in AutoCAD and to translate them into ARC/INFO and MapInfo system was studied in the process of the establishment of it's spatial database. This method will set a good example for other cities in China.

2 THE DATA CLASSIFICATION AND CODING STANDARD FOR URBAN GIS

2.1 The principle and foundation of data classification and coding

The sources of the spatial database is the topographic maps, so the foundation of data classification is the current national specifications for cartographic symbols for topographic maps. The classification standard should be Under the purpose of urban GIS, database management, urban planning, urban construction and urban management, and should be set based on the investigation in many sectors like public security, traffic, gardens, telecommunications, environment protections, statistics etc. The principle of data classification and coding is:

. Scientific and systematic, to classify the cartographic element of large scale topographic map strictly and scientifically so as to form a whole coding system.

. Consistency, all professional names and classification must be conceptually same.

. Uniqueness, every cartographic element of topographic map only has correspondingly one kind of code.

. Expandability, the design of the standard must consider future development so as that the standard system will not be disturbed when new codes are added

. Stability, the coding standard could be kept during a long time.

. Suitability, the standard must be suitable to data collection for GIS and computer-assisted mapping, the classification should be reasonable and the length of the code should be as short as possible, So as to make the code be remembered easily.

2.2 The structure of the code

According to linear classification method, the topographic elements can be classified to 10 first

level categories, and then classified further to the second level categories, and to the third level categories or the fourth level categories according to the demands of urban planning, urban construction and urban GIS. Only the codes of the fourth level categories use 0~99 intergers, other categories use 0~9 integers, the code of a topographic element are made up by above categories finally.

During the process of data classification and coding, the basic content of the attribute data for spatial data can also be defined according to the users' demands. For example, the attributes of road code, road name, road segment, turning impediment, one way-road etc. have been defined for road element according to the demand of the traffic sector.

3 THE TRANSLATION OF DATA FORMAT BETWEEN DIFFERENT SYSTEMS

3.1 The problems

There lies several problems when translate the data collected in AutoCAD to ARC/INFO system and to MapInfo system.

1) When used AutoCAD to translate the dwg file to be dxf file, and use ARC/INFO to import dxf file to a coverage, we can found that only about 50% to 70% of spatial data like point, line, can be translated successfully, others like shape, block, linetype can not be translated completely like its original state.

2) How to collect a lot of attribute information in AutoCAD and to translate them to ARC/INFO and MapInfo system is also a problem which will be urgently solved.

3) When used the MapInfo's arclink model block to translate ARC/INFO's coverage to be MapInfo's table, we found that although the spatial data can be translated into ARC/INFO system successfully, but ARC/INFO's adjacent polygons can not be translated to be MapInfo's adjacent regions correctly. Usually only one of the adjacent polygons can be translated to a region, As to attributes, they can be translated to MapInfo successfully.

3.2 The different of data format between 3 systems

The drawing entity of AutoCAD includes point, line, polyline, shape, linetype and block etc. Among them, point, line, polyline can be translated into ARC/INFO system successfully, Only the basic point of block and the basic line of linetype can be translated into ARC/INFO system, this is because block, shape and linetype are so dependent to AutoCAD environment. Anything of shape can not be translated into ARC/INFO system. In AutoCAD system, every drawing entity has a single handle, but there are no attribute data joined to drawing entity in this system.

The link of spatial data to attribute data is the typical characteristic of ARC/INFO system. When a coverage is built, the topology structure and the feature attribute files of points, lines, polygons can be created. A MapInfo's table also have point/line/region (polygon in ARC/INFO) attributes, but it lacks topology structure. For example, in MapInfo system, a region is formed by its boundary lines, If two regions have a same boundary line, only one region can be formed, another region can not be formed successfully. In ARC/INFO system, two polygons can use the same

adjacent boundary line to form their own polygon topology structure separately.

3.3 The solutions

In order to translate spatial data and attribute data successfully between above 3 systems, We use several methods during the process of data collection and data procession

1), When collect spatial data in AutoCAD system, avoid using shape, we use block or linetype to make the point symbol and line symbol for some topographic map elements. Because the basic point and the basic line of block and linetype can be translated into ARC/INFO system successfully.

2), When collect attribute data in AutoCAD, we save the attributes of the elements of topographic map to a dbf file and add the element's handle in AutoCAD to one field of the dbf file. This handle can join the spatial data in dwg file and the attribute data in dbf file successfully.

3), When collect polygons in AutoCAD, we digitize the same boundary line twice times using snap tool. After the AutoCAD's data was translated to ARC/INFO system, we can use clean command to combine this two boundary lines to one line in ARC/INFO. When the data was translated to MapInfo, two closed regions can be formed correctly due to the two overlapped boundary lines.

4 CONCLUTION

The solutions of above 2 problems make it possible to translate data from AutoCAD to ARC/INFO format and then to MapInfo format successfully. This method have been used in data collection work of the spatial database for urban GIs of Nanjing, The database covers 243 sq. Km and adapts to AutoCAD, ARC/INFO and MapInfo software, and adapts to all user's GIs systems too. It is proved that this method is an effective and practical data collection, data process method, and has a practical value in China.

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