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Comparative Analysis of CASS and ArcGIS Parcel Fabric Tools for Enhancing Urban Cadastral Management

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Abstract:

CASS software, developed by Guangdong South Digital Technology Co., Ltd., is an advanced system built on CAD. It encompasses functionalities such as terrain modeling, cadastral management, spatial database creation, engineering applications, and earthwork calculations. Over more than a decade of stable development, CASS has matured technologically and gained widespread market acceptance across China. Its user base spans various industries, including surveying and mapping, land management, urban planning, property, municipal services, environmental protection, geology, transportation, water conservancy, electric power, and mining. This paper focuses on the integration of urban cadastral management theories and land information systems with the CASS software, particularly examining the cadastral map toolbar as the primary research object. Additionally, it integrates ArcGIS Parcel Fabric tools to enhance urban cadastral management, providing a comprehensive basis for effective land administration in urban environments.

Keywords:

CASS, urban cadastral management, ArcGIS.

1. Introduction

With the rapid development of urban construction in China today, the design of urban cadastral management information system has become an important part of supporting the urban construction work in China, and the healthy and safe development of urban cadastral management has become the top priority. Governments at all levels of urban cadastral management implement a series of working measures for the purpose of obtaining cadastral data of cities and towns, comprehensively studying the ownership, natural and economic conditions of land, and establishing cadastral maps, books, books and databases. Its main contents include land survey, registration, statistics, grading valuation and cadastral file management and urban cadastral mapping mapping.

This paper mainly analyzes and studies what is urban cadastral management, analyzes the current situation of urban cadastral management information system design in China, discusses the main content of urban cadastral management, takes urban cadastral mapping as the main research content and makes urban cadastral map by using CASS software.

2. Research contents

This paper is mainly based on CASS software, comprehensive application of CASS software and urban cadastral management, land information system basic theory and method of knowledge, combined with the related technology software, according to the management department and the Guangdong Guangzhou tianhe district data instance, in the CASS platform, using the cadastral map tool of urban cadastral map, attribute input editing, map output. Finally, we compare it with ArcGIS Parcel Fabric to find out the feasibility, advantages and disadvantages of CASS software applied to urban cadastral management in China. In the process of drawing, it attaches great importance to the system and practical operability, and provides important guidance for the scientific, comprehensive and complete urban cadastral management.

Main research contents of this paper:

⑴ In-depth analysis and study of the structure and function of CASS software, combine it with China's local urban cadastral management information system, and formulate the relevant urban cadastral mapping technical scheme.

⑵ Through the actual operation of CASS software in Guangzhou City, Guangdong Province, understand the core of urban cadastral management, find the advantages of CASS software, find out the possibility of combining CASS software with the current domestic urban cadastral management information system, and lay a foundation for the application of CASS software in the future.

⑶Compared the CASS software with the domestic urban cadastral management information system, take the ArcGIS Parcel Fabric based on ArcGIS as an example, compare the similarities and differences, find out the merits of ArcGIS Parcel Fabric, and apply it to the domestic urban cadastral management.

3. Overall functions of the CASS town cadastral management module

Cadastral management module is a part of cadastral management used in CASS software, which contains many functions, such as drawing ownership lines, editing boundary address points, site editing, input and editing of attributes, generating cadastral tables, graph output and so on. The following analyzes the main function of CASS cadastral map tool bar and the structure of urban cadastral map.

3.1. The concept of a town cadastral map

Urban cadastral map is a special map reflecting the land management of cadastral elements, including boundary points, administrative boundaries, cadastral neighborhood boundary, boundary line, land class, cadastral number, area, location, land user, land grade, owner and land grade, and also reflects the land objects and written notes closely related to the cadastral

[1].

3.2. The content of the town cadastral map

3.2.1. Urban cadastral elements

⑴Administrative boundaries at all levels: when the administrative boundaries of the two levels share the same overlapping administrative boundaries, they are represented as advanced boundaries on the cadastral map, and the realm line draws points or lines at the corner and the line cannot be interrupted.

⑵ Boundary address elements: boundary point (with 0.8mm diameter red circle), boundary line (with 0.3mm red line, and the ground boundary line overlap other boundaries, can jump note on the cadastral map), cadastral neighborhood boundary, urban and rural integration of collective land ownership line, the collective land owner name are noted in the collective land ownership line.

⑶ Cadastral number: The cadastral number is composed of the district and county number, street number, neighborhood number and lot number, and you only need to note the street number, neighborhood number and lot number on the cadastral map. The street number and neighborhood number are moderate; the lot number is marked in a parcel; the note of the lot number is marked in a parcel (the numerator represents the lot number, the denominator is the lot class number); for the plots spanning the plots, the lot number must be noted in each part of the different plots.

⑷Land category: the land category shall be noted according to the land use category code stipulated in the National Land Classification system, and the land category shall be divided into three levels. For the residential land with small land, can be omitted, other kinds of land code shall not be omitted.

⑸Location: The location of the lot is composed of administrative district name, road name (orplace name) and house number. The administrative region name and road name should be appropriately noted, and the house number of the lot can be selectively noted.

⑹Land user or owner: the name of the unit and the collective land owner can be selectively noted. The name of the land user of the personal land need not be noted.

⑺Land grade: the towns that have completed the land grading and valuation shall draw the land classification boundary and the corresponding land grade notes on the cadastral map.

3.2.2. Urban land and elements

Land elements include: buildings, roads, water system, landform, independent features, notes, etc.

⑴Building: in the cadastral map to draw the fixed building covers the area status. Non- permanent buildings such as sheds and simple houses; ancillary buildings such as balconies, awning and steps; the details of the building such as brick columns outside the wall or small decorative details; houses less than 6m2 can be given up; large units and steps with large areas and awning with columns; large or linear structures; the patio or courtyard in the building complex should be indicated on the cadastral map when greater than 6m2.

⑵Water system and road surveying and mapping: road surveying and mapping should mark on the pavement materials (pavement materials have concrete, asphalt, brick, etc.) and technical grade. Large flower beds in public places; intersections of roads and road bridges; main ancillary facilities of roads; embankments of roads should be represented, but dense railway tracks can be selected; ditches or river corners, the width of ditches is greater than half a meter; the river reservoir and main auxiliary facilities should be represented, and generally ditches and embankments should be separated.

⑶Landform land mapping: artificial construction of slope or obstacle, naturally formed slope,ridge to be marked on the symbol; the ridge in more than one meter with the double line to express, and less than one meter with 0.2 mm single line to express. If the symbol size is smaller than the footprint on the map, draw the land range line and mark the corresponding symbol. For relatively small residential land, the tower pavilion in the park can not be annotated, but other land codes must not be omitted.

⑷The coordinates of the grid line and the outline of the graph coordinates must be noted. Thescale of the external survey of the map should be noted, the elevation and geographical name should be noted in the areas with large fluctuations, and the relatively flat areas should not indicate the landform.

⑸Independent features: independent features have their own corresponding ground symbols. In the square or on the open-air structures and public facilities, the boundaries of these independent land and land areas should be drawn, and the corresponding symbols should be marked. High voltage lines covering towers and towers, large area of park green space should be expressed; communication lines and power lines, general overhead pipelines, small green space and scattered vegetation need not be indicated [2].

3.3. Structure and function of the urban cadastral management module

The cadastral map toolbar in CASS software is a tool bar used to perform a variety of urban cadastral mapping functions, which can be very convenient and fast for the editing, attribute input and modification. The study of urban cadastral mapping tool bar is an extremely important part of the study of urban cadastral mapping.

3.3.1. Overall function of CASS town cadastral map toolbar and its related toolbars

The use of cadastral map tool bar in CASS software and the tool bar to solve various cadastral problems contain many practical functions, such as the generation and drawing of ownership

graphics, consolidation and modification of ownership file data, decoration and modification of ownership file attributes, ownership file data export and other commands.

Cadastral mapping tool bar has an extremely important role in CASS software, and all the operations of urban cadastral mapping need to use its operation, which is a very important core.

1Table 1 Detailed functions of the urban cadastral map toolbar

tool	explain
Draw the ownership line	Display a dialog box on the desktop, enter the data according to the requirements in the dialog box, and click the OK button. The system will input the lot number, the right holder and other information data into the authority boundary, so as to form a closed lot [3].
The composite line turns to the ownership line	Draw the closed line meeting the relevant requirements in the commandline input PL line draw the area range, point composite line into the ownership line, can directly turn the just drawn closed line into the ownership line [4].
Generation of the ownership file	This tool bar has ownership merge, generated by graphics, generated by compound line, generated by boundary address line, and ownership information file merge function.
Draw the ownership diagram according to the ownership document	Load the existing ownership file to draw the ownership diagram.
Modify the boundary site number	Modify the boundary address point number following the command line prompt.
Rerow the boundary site number	If the order of the sites is chaotic, you can use the function to rearrangethe points in the neighborhood All boundary address points are reordered [5].
Set the maximum boundary address point number	Follow the command line prompt to enter the new maximum address number.
Modify the address number prefix	Enter the fixed address number prefix letter from the command lineprompt.
Delete the useless boundary address point	Delete the landmark circle through which all unbounded address linespass.
Note the dot number	The software can automatically determine the reigned boundary point during the actual operation. On the map, the boundary site number[6],local note, delete the note function.i
The boundary site point circle is modified	The subordinate circle is cut to generate the extinction function andcancel the extinction function.
Adjust the order of the boundary site points within the site	Select the site and adjust the order of the boundary address points.
The boundary address point generates the data files	Click to generate a data file.
Find a lot	Click the pop-up dialog box, according to the lot number, land usecategory, the right holder finds the site.
Find boundary site points	Click the pop-up dialog box to find the boundary address point accordingto the boundary address point number.
Site plus boundary site	According to the command line to indicate the insertion point positionand add the boundary site point to the site.
The land merger	Merge the different plots according to the command line prompts.
Sector division	Enter a PL line following the command line prompt to split the site.
Land reconstruction	Select the boundary line according to the command line prompt to reconstruct the site.
Modify the building properties	The subordinate set up the structure and the number of floors, notes theside length of the building, calculates the building area of the lot, notes the building area, the building reconstruction, and the building attribute function.
Modify the plot property	Click on the pop-up site property table.
Modifies the address properties	Click the pop-up boundary line attribute dialog box to modify the boundary nature, boundary line category, boundary line location, the boundary person of the field, the date of the boundary, the boundary person of the adjacent family.

Modifies the bound address point property	Click the pop-up boundary point attribute input dialog box to modify the boundary mark type and boundary point type.
Output land properties	Data results output, generation.mdb document.
Read into the property of the plot	Automatically save to a folder.
A map of the boundary site	Subordinate insertion point map box, drawing point map, dimension annotation function.

1. Data extraction function:

(1)Start the CASS software.

(2)Then click read the station data, the system will automatically pop up the station memory data conversion dialog box.

(3)Set the instrument model for the field use in the dialog box, and enter the specific data information and file name below

(4)After the setting, click the conversion button. After the conversion, the subsequent town cadastral drawing can be done.

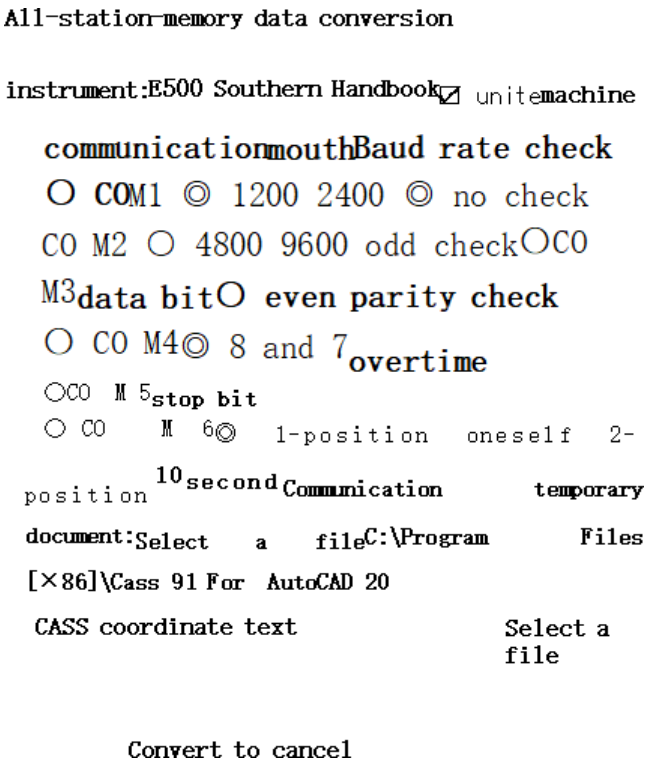

Figure 1: Read the data dialog box in the whole station

2. CASS urban cadastral tool bar function application

When using CASS software to edit the urban cadastral map mapping, there is a complete set of operation steps. The application in the urban cadastral survey is roughly reflected in six aspects: field map formation, drawing and generation, ownership information input, data quality inspection, submission of chart results and data conversion into storage [7]. As shown in Figure Figure 22:ii

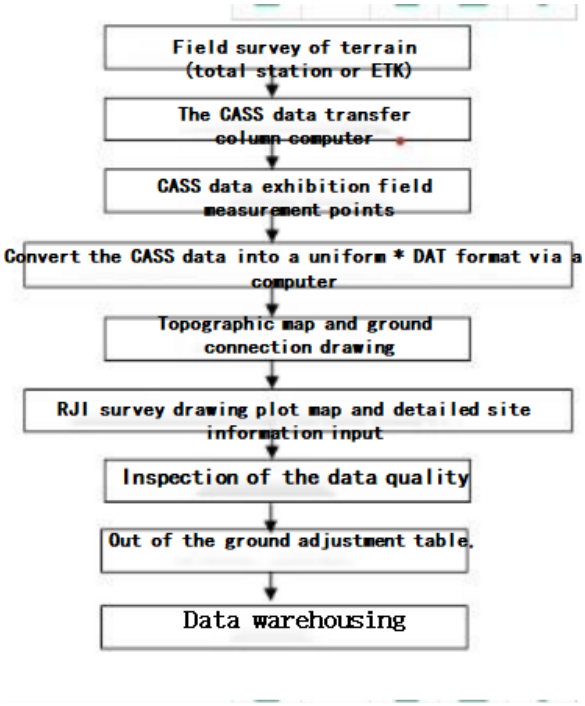

Figure 2: Editing process of urban cadastral map

3.4. Editing process of urban cadastral map

3.4.1. Acquisition of the data

In the planning area of urban cadastral mapping, the mapping equipment (such as the full station) is installed according to the basic point, and the equipment is connected to the computer system so that the collected data can be transmitted and input into the computer system.

The operator opens the CASS software in the computer, selects the appropriate scale on the interface, and changes the scale through the "Change current topographic scale" menu until thescale is realistic[8].

Click the data collected by the data tool bar in the CASS software, read the data according to thepop-up dialog box instructions, and prepare to edit the data into the map[9].

3.4.2. Drawing the urban cadastral map

In the cadastral map tool drawing ownership line options, according to the corresponding requirements in the dialog box in the specific attribute information, click sure after the corresponding information input to the ownership boundaries, for test area cadastral number work to number according to the four levels, including administrative region, neighborhood, neighborhood, land, ownership boundary is need to neighborhood as the basic unit (after the completion of ownership boundaries drawn to mark clear boundary points) [10].

3.4.3. Generate urban land sketches

There are two ways to generate town plot sketches: batch generation and single plot generation.

Method for batch generation

(1)Click the map map box under the cadastral tool bar.

(2)Select the right paper and click on the batch processing.

(3)With the mouse on the screen batch to select the boundary address line can be divided intoa row of multiple maps at a time.

The method of generating a single lot

(1)Click on the cadastral parameter setting option under the file toolbar.

(2)In the map scale denominator multiple bar fixed input 100, in the site number in the number, plot graphics selection, then select the map parameter setting interface, selected to save the file, select field coordinate location, click sure, generated the sketch according to the national unified standard requirements after finishing become a standard map [11].

3.4.4. Summary of urban cadastral map area

Draw complete town area ownership line, capture ownership line inflection point, draw a closed neighborhood line, running figure spot line check wrong, find out and modify the suspension, cross, overlapping figure spot line, ensure only a boundary line between the figure spot, make the sum of the figure spot area and the neighborhood area, click on the urban land classification area summary table, selected neighborhood, generate area summary table [12].

3.4.5. Classification of urban cadastral map

After the map is drawn, the map can be printed according to the proportion of the map.

Click the CASS parameter configuration option under the file tool, set the unit name, drawing date, coordinate system, surveyor, monitor, inspector, compact input, in the drawing processing batch amplitude or standard amplitude (generally choose 50cm * 50cm square amplitude), input cadastral map name, and save the standard cadastral map map [13].

4. Application of CASS urban cadastral management function in Tianhe District of Guangzhou city, Guangdong Province

In recent years, China attaches more and more importance to the urban cadastral management information system, and the invested manpower, material resources and financial resources are also constantly improving. Therefore, it is necessary to study the application and development prospect of CASS urban cadastral management application function in China. The following is the application of CASS software in the application prospect of CASS software in urban cadastral management information system in China.

4.1. Overview of urban cadastral structure in Tianhe District, Guangzhou City, Guangdong Province

Tianhe District is located in the east of Guangzhou city. It was established in 1985 from the suburbs of Guangzhou. It is connected with Huangpu District in the east, Haizhu District across the Pearl River in the south, Guangzhou Avenue and Yuexiu District in the west, and Baiyun District in the north. The administrative area covers a total area of about 137.38 square kilometers and has 21 streets under its jurisdiction. By the end of 2017, Tianhe District had a registered population of 902,800 and a permanent resident population of 1.6979 million.

4.2. Construction of urban cadastral structure in Tianhe District, Guangzhou City, Guangdong Province

4.2.1. Generate floor generated using simple method

The working mode of simple code identification is also called "the automatic drawing mode of coordinate data files with simple coding format"[14]。

1. Set the display area

(1)Select the fixed display area option under the drawing processing tool bar.

(2)Open a second under the demo file. The adt file, to complete the fixed display area. The lower command area displays the minimum coordinate (m): x=30029.824; y=40029.646 Maximum coordinate (m): x=30320.004; y=40370.059.

2. Simplified identification

(1)Click the simple code identification option under the drawing processing tool bar after the system automatically draws the town ground object plan on the screen.

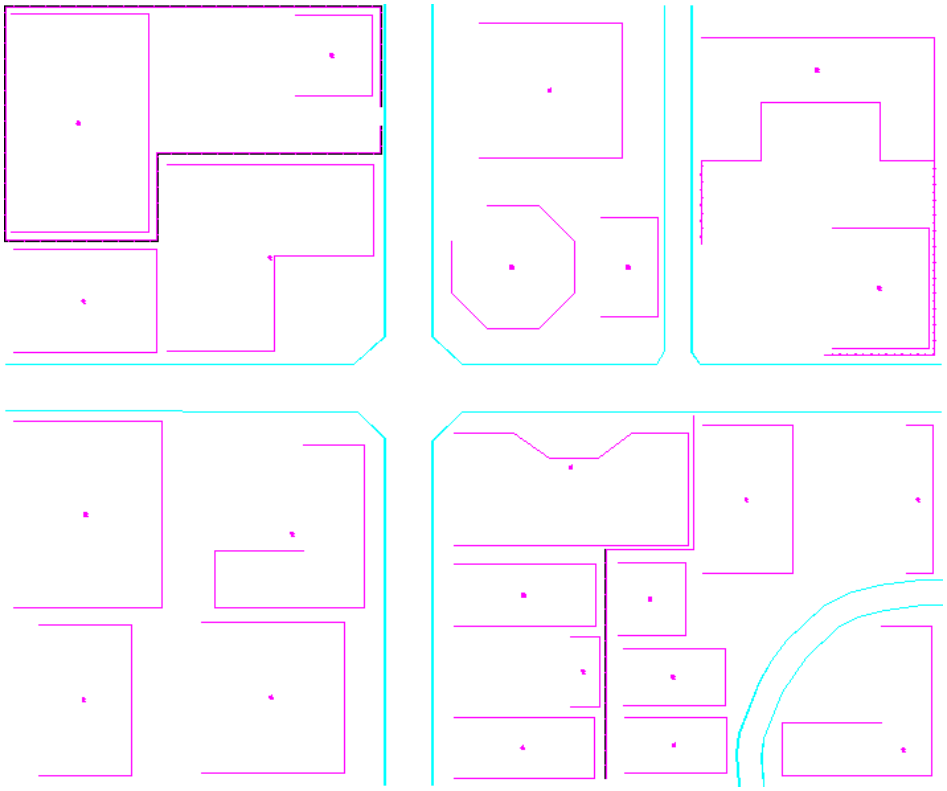

Figure 3: The plan of the town land features

4.2.2. Generate the ownership information file according to the town plan plan

(1)Click on the exhibition field test spot number option under the drawing processing tool bar, and select the health in the pop-up dialog box. Point number of field data displayed in the dat file.

(2)Select the point number under the right toolbar and select health in the displayed dialog box.dat document

(3)Then select the graphic generation option under the cadastral map tool bar, enter the data file name of the cadastral ownership information according to the prompt in the command area,and save it in the appropriate path.

4.2.3. Map the cadastral map of urban ownership in Tianhe District, Guangzhou City, Guangdong Province

(1)Select the cadastral parameter setting option under the cadastral map tool bar to set the drawing parameters.

(2)Set the annotation mode and parameters according to the actual data.

(3)Select the ownership map from the ownership file under the cadastral map tool bar, enter the ownership information data file name according to the pop-up dialog box, and enter the scope of the cadastral map to draw according to the prompts in the command area.

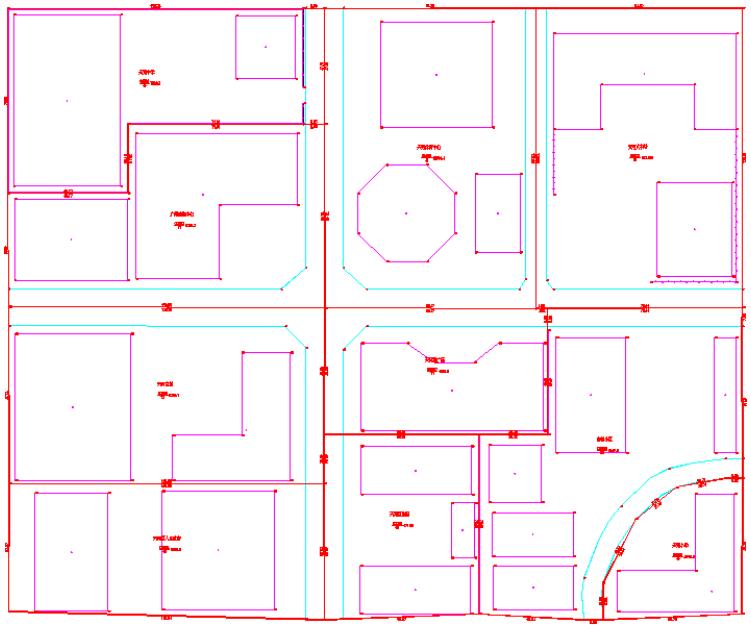

Figure 4: Town cadastral map generated by using the ownership document

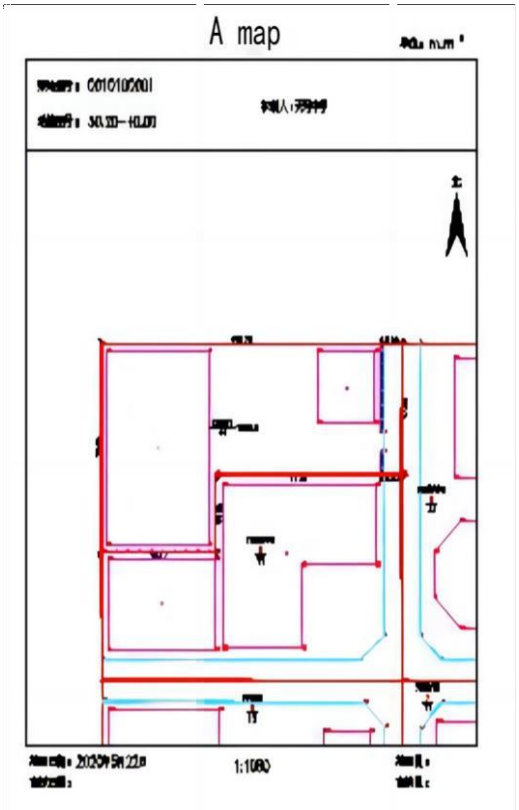

Figure 5: Batch production of the zong map

4.2.4. Draw a map of the towns

(1) Click on the drawing Zong map box option under the cadastral map tool bar.

(2) Click the batch processing option in A4 vertical option, specify any position with the mouse according to the prompt of the command area, and the map is automatically drawn in the formulation location. Take lot 0010100001 as an example, as shown in Figure 5:

4.2.5. Draw the urban cadastral form

Generlist of results through the cadastral mapping tool, as shown:

Table of results of boundary site | S 1 II | Code 1 1

Site No. 0010400010

A place name is not elementary school

Land area (square meter) 2,613.8

The building covers an area of "square") 1307.1

bounding point coordinates

order	punctua	Born 6		The
		xDn)	Y)	
1	4	30107.879	40350.059	55.46
2	2	30052.219	03434.00	56.70
3	8	30048824	40282900	15.08
4	sun	30004.E09	40292980	9.34
5	7	30090.975	40302434	21.20
6	6	30104013	40323.150	20471
7	5	30107.670	4034345	6.52
1	4	30107.E79	40350.059	

Summary table of land area by street

marketdistinguish__1__road

Item the earth book Numb ber	Ground class name area Column two segments of nitrogen with two segments)	Ground class code	area (M²)	The governor notes
010100001	Number of education	44	750928	
010100002	Industry services	11	8299.25	
010200003	Falling travel industry	12	9284.08	
010200004	Medical health	45	6946.25	
010300005	Literature, body, media	41	10594.39	
010300006	road	61	1054228	
010400007	Direct road industry	11	4896.58	
010400005	Close, direct pass	42	4716.92	
010400009	Residential use north	50	9547.89	
010400010	Number of education	44	2813.77	

Figure 6: Table of cadastral results

5. The comparison of CASS town cadastral structure management function and ArcGIS Parcel Fabric

ArcGIS Parcel Fabric The function of land structure management is mainly applied in foreign countries, but China does not use it for urban cadastral structure management. Compared with urban cadastral management in China, it has certain advantages, and it is feasible to apply it to urban cadastral management in China.

5.1. Comparison between CASS town cadastral structure management function and ArcGIS Parcel Fabric

The CASS mapping system is a set of software system developed based on the CAD platform, integrating terrain, cadastral, spatial data database construction, engineering application, earthwork calculation and other functions 22. The cadastral management data of most cities and towns in China are edited and recorded by the South CASS mapping system, which has its own advantages and disadvantages. Compared with ArcGIS Parcel Fabric cadastral structure tools, each data has its own advantages. The coordinate system of CASS mapping system basically uses the Cartesian plane coordinate system, so it is particularly suitable for editing and managing the large scale digital map. Moreover, there is no latitude and longitude in CASS, so the measured points must be projected into a plane format for subsequent operation. And ArcGIS Parcel Fabric cadastral editing is based on the geographic coordinate system, namely longitude and latitude. Moreover, when the whole system of ArcGIS is correctly determined by spatial reference, the data in various coordinate formats can basically fit.

At present, many often used symbols in CASS, such as Bridges, cave dwellings, points, line groups, etc. The separation of symbols and data is not good enough, and the display information such as color and line width is directly stored in the data []. While ArcGIS ParcelFabric uses the technology of data-driven mapping, which can well improve the editing efficiency of the small- scale field structure.

The big problem of CASS is that there is no concept of perfect surface, there is a big problem in the performance of special surface elements such as enclaves, and the area calculation is difficult. And the two data format is better than the ArcGIS. But the CASS command-line window is very good, which makes us much more efficient when editing cadastral structures.

For ArcGIS Parcel Fabric, its coordinate conversion function is excellent, its library construction also has its own natural advantages, and its spatial analysis function is much more convenient and faster than CASS. However, although it can be directly connected with field data, CASS is better in the compilation and management of large scale plots because the whole ArcGIS needsto handle various data.

5.2. Combination of CASS town cadastral structure management function and ArcGIS Parcel Fabric

In the process of urban cadastral structure management in China, the best method is to combine ArcGIS Parcel Fabric and CASS, give full play to their respective advantages, and better contribute to the management of urban cadastral structure in China. Make China's urban cadastral management more convenient and efficient.

First of all, CASS is more convenient to collect sites in the field, so the data collection and editing of various urban cadastral sites involved in the field are carried out under CASS. CASS is still relatively comprehensive in the editing of urban cadastral information, so the early information and collection are completed under CASS.

Then the data format of CASS was changed to ArcGIS format, and the following surface structure establishment and spatial analysis were edited in the lot structure under ArcGIS, including the final map construction database.

This not only gives full play to the advantages of CASS, but also makes up for the deficiencies in the management of urban cadastral structure in China through ArcGIS Parcel Fabric local management tools, which is of great significance for the more convenient editing and management of urban cadastral structure in China in the future.

6. Conclusion

According to the relevant methods and theories of urban cadastral management, combined with the specific urban data of Tianhe District, Guangzhou City, Guangdong Province, this paper studies and discusses the application and technology of the current urban cadastral management in CASS, and studies the ways and characteristics of urban cadastral management and editing of CASS. We can find that the operation of urban cadastral management based on CASS is convenient, its attribute input is clear at a glance, and the content is very comprehensive, and the operation functions are very diverse, which can well carry out the operation of all aspects of urban cadastral management, and some of the functions make the operation steps very smooth. The following main conclusions obtained in this paper are as follows:

(1) Through the analysis of CASS software functions, the paper can master local editing, boundary site editing, attribute input and modification, table output and graph output, which enable us to gain more understanding of the operation theory and requirements of CASS.

(2) This paper not only makes a detailed analysis of its functions, but also makes a detailed study of the operation mode of CASS town cadastral management functions. In addition to the display operation of the basic information of urban cadastral structure, CASS urban cadastral management function also has the operation of creating new plots in the current urban cadastral, merging and dividing plots, and correction of local structure.

(3) By studying the examples of urban cadastral data in Tianhe District, Guangzhou City, Guangdong Province, China, conducting the practical operation of urban cadastral structure management of CASS, and proving that CASS has many advantages and practical possibilities through practical operation.

(4) Through the comparison of ArcGIS Parcel Fabric and CASS, the editing and management of urban cadastral management will be more perfect, and it will provide high-quality, convenient and fast services for the land resource management departments in the future. The combination

of the two makes up for the deficiencies in the management of urban cadastral structure in China, which is of great significance for the more convenient editing and management of urban cadastral structure in China.

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