e-Taiwan with Cadastral Information Database

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This paper discusses the application of GeoSpatial Technologies in extending the utility of cadastral information. Topics covered include cadastral survey assistance, land price management, topographic map integration and 3D building management. The application of computerized cadastral data is illustrated by means of these applications, thus demonstrating the role of geospatial tools and techniques in building a more efficient e-government

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IN TAIWAN, the ownership of a piece of land is considered to be of paramount importance. For registering and ensuring land ownership rights, cadastral maps were surveyed and georeferenced in land information system (LIS). Cadastral Information is considered as a basis of a comprehensive public development and national construction data warehouse, influencing land management tasks significantly. A project namely e-Taiwan has been undertaken by the Taiwanese government with the ultimate objective of building a comprehensive Cadastral Information Database. The foremost goal of this project is the creation of computerized cadastral data. Upon successful completion of this project, land authorities and other related governmental agencies can function with enhanced efficiency.

THE APPLICATION OF INTEGRATED GEOSPATIAL TECHNOLOGIES

We are currently witnessing tremendous advances within the fields of information technology and telecommunication technology. These have contributed both directly and indirectly to the spheres of surveying and mapping technology and pushed them ahead. The integration of spatial information science and surveying and mapping technology has led to a breakthrough from traditional surveying and mapping tasks. This successful integration can be attributed to the development and amalgamation of GIS, GPS and RS technology, the so-called 3S technology (GeoSpatial technologies).

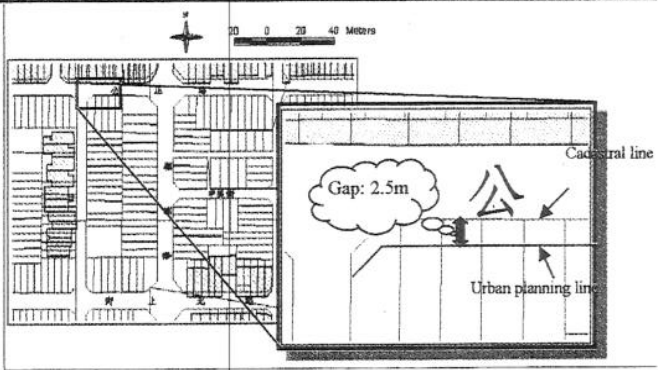
At present, the ways in which cadastral information is being handled have improved significantly and several novel trends have evolved in applications involving such cadastral information. First and foremost, traditional man-made operations have now been transformed into computerized (and mobile) surveying and mapping. Cadastral information databases and access have changed from a public works application into a civilian necessity. Finally, spatial data management has evolved into mobile message transmission. For instance, the traditional cadastral map only records the geometric data as point and line, lacking user-friendliness and readability. To achieve this, survey personnel have to show up together with other public development staff when they need on-the-spot survey. Owing to these aforementioned reasons, the multi-objective cadastral map promoted by Taipei city elicited good response. In traditional cadastral maps, block, road nameplates and important landmarks are marked; furthermore, "Taipei city orthographic cadastral map production and application system" and "mobile digital survey assistant system" have been developed. These receive the cadastral information and attribute data via internet, and offer the reference to surveyors looking forward stake point and on-the-spot examination.

The application and development of cadastral information and its link with geospatial technologies are as follows:

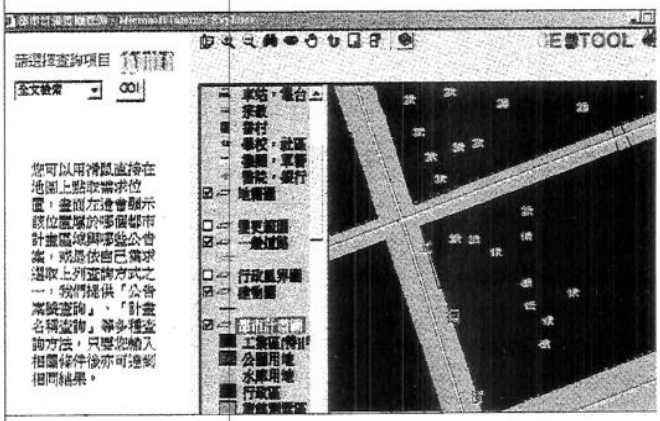
1/1000 digital topographic map integration and application

The varied coordinate projection systems adopted by cadastral survey, such as cadastral coordinates and scales, pose a challenge to cadastral map integration. The cadastral coordinates such as TWD67 coordinates, TWD97 coordinates, etc., and the scales, such as 1/500, 1/600, 1/1000, 1/1200, 1/3000, 1/6000, etc. were also different and the cadastral survey records and

map layer storage were distinct. Furthermore, since the topographic map and cadastral map were made by different departments, they lack consistency. The urban planning maps were produced using the topographic maps as base maps. Hence, when these three basic maps are used together the result is highly incoherent. For example, a gap between cadastral line and urban planning line is observed when they are overlaid. (Figure 1). The integration of cadastral survey and topographic survey links becomes difficult for municipal planning authorities and thus complicates the execution of public policy. It is thus vital that GIS is used to integrate these three maps in the data construction stage. It helps to avoid the problems of overlay error and aids multi-objective application. (Figure 2).



▲ Fig 1 The drop in cadastral, topographic and urban planning maps overlay

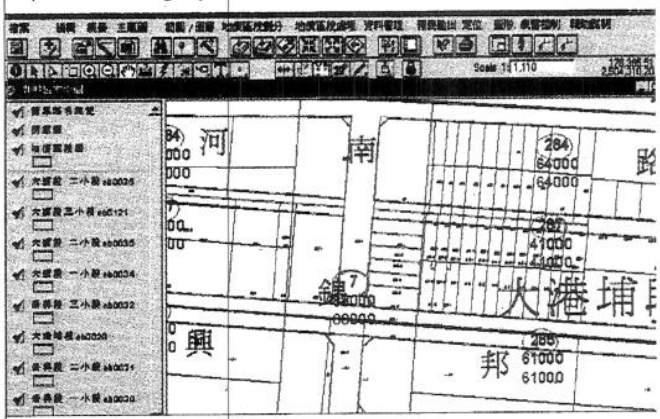


▲ Fig 2 3 maps integration application: Urban planning map inquire system (From: Kaoshoung City Government, R.O.C.)

Land price section assistance and application

Land price evaluation, taxation and compensation for land levy are all inter-related, and are important sources of finance to government. Land tax is local tax in R.O.C., so it contributes to local finance and popularizes local construction. For formulating fair and reasonable land taxation, preventing infringement into people's rights, and steadying the taxation sources, it is necessary to build a set of reasonable operating procedures, and assist officers in carrying out the operations.

This operation (Figure 3.) uses land price section map and digital cadastral map as main feature data, overlays topographic map, urban planning map, etc., and edits the land price area boundary using computer (Ho, 1999). The method is roughly the same as land price estimation, but it is assisted by computer drafting technique to improve the expression of land price section, and also aid the annual land price appraisal meeting. Due to the integration of feature and attribute database, the efficiency of parcel land price calculating function is improved substantially, and facilitates data preservation, management, search and readability.



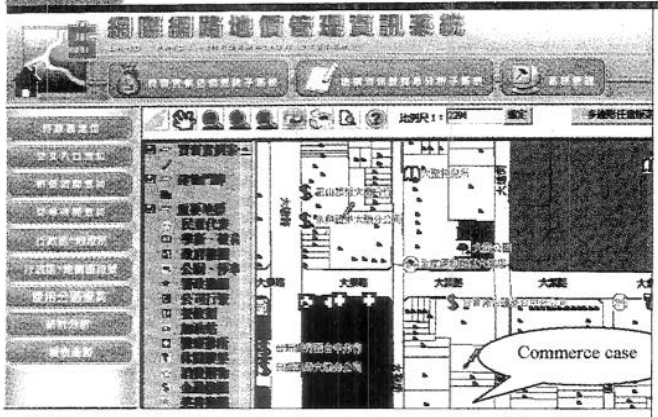
▲ Fig 3 Land price section divided application system (From: Kaohoiung City Government, R.O.C.)

Land price information and public service application

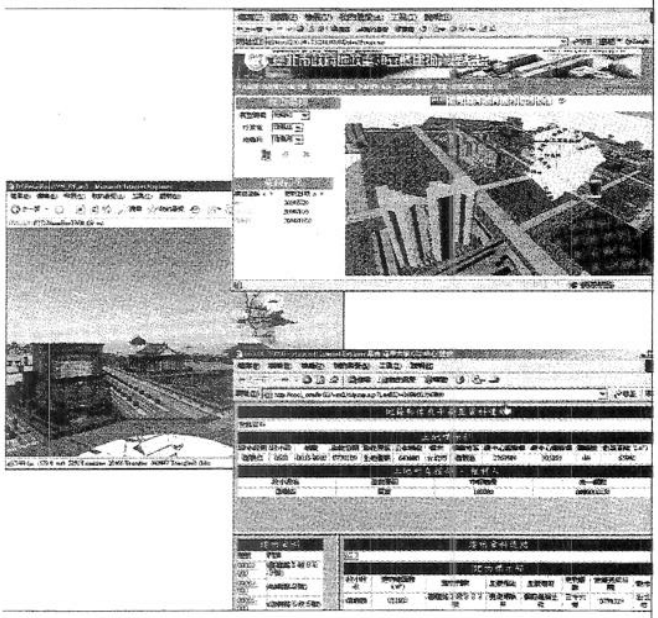
For controlling land price effectively and promoting transparent land price strategy, Taichung City Government has employed the internet (Figure 4). The WWW is used to offer integrated Web-GIS for developing "Real Estate Trading Instance from Land Investigation and Estimation" and "Land Price Management Operation System". These could be surfed and land price spatial information can be retrieved by means of interactive search. The system utilizes cadastral map, administrative region map, zoning map, important land-marks, buildings, door plates, and road map. The system integrates the database of "Land administrative integration system" with "Land Price Section Divided Application System" to offer citizens a free, instance, and user-friendly service about the real estate trading price, and the citizens can also obtain public facilities information from the system. In a shift towards the realization of the objective of e-governance, the land price information on line system and automatic report analysis and production system are developed.

3D building management

3D building management system (Figure 5) uses the existent cadastral map to produce the 3D building models. The system links the 3D building models to their information, and employs GIS and VRML (Virtual Reality Modeling Language) to depict the 3D image of building. The web surfer can see the



▲ Fig 4 Land price inquiring system offers greater convenience to the citizen. (From: Taichung City Government, R.O.C.)



▲ Fig 5 3D building management system (From: Taipei City Government, R.O.C.)

3D virtual world, and simultaneously search the attribute data. Building information includes images and the completed layout when the building license was issued, and the information would be applied to architecture management. It would be combined with the cadastral data to produce the synthetic building data, and expanded to urban planning, city design, and residence policy analysis.

Public works management

In road construction management, the construction is according to the planned road by urban planning and is budgeted by local government year after year. However, the construction process involves an inextricable operating procedure, like the proposal, on-the-scene survey, checking and ratifying, expenses application, land acquisition, compensation granting, constructing proceeding, etc. Nowadays, the management system offers the information for the related directors and officers to build, search, estimate the land acquisition fee and control the road data via Web GIS technology. A mobile GIS is developed to offer search function and reports using PDA as hardware.

Monitor in Home Land

The home land conservation authorities are on the look out for a comprehensive solution to the problem of illegal landuse. However, since the slope land is too vast to manage and the authorities are understaffed, it is impossible to overhaul on-the-spot. "Slope land Management and Satellite Image Monitoring Program" integrates GIS, RS and GPS to check the basic information of questionable translation area by image analysis. The function of satellite monitor is separated into 2 parts: questionable translation area of satellite images determination and investigation management. The former one focuses on the analysis of questionable translation area through satellite images, and the latter one focuses on verifying on-the-scene and slope land management (Chou, 2003). The research plans to verify on the spot, download the questionable translation area data to PDA (with Slopeland Supervision On-the-spot System) which integrate the cadastral information and to investigate 'land registration data', 'ownership or obligor data', 'land use behavior', 'verifying results' and so on, record the results to questionable translation area verifying form, and take pictures.

PROSPECTS

The computerized cadastral data linking with geospatial technology itself still has some inherent limitations. These include the problem of integration of different coordinate systems, scales, precise, surveyed and mapped methods, storage formats, and the matching problem between boundary adjacent cadastral sections, etc.. Besides, the problem of integrating different databases is also critical. The only way to accelerate the rate of progress of cadastral resurvey in Taiwan is by means of the numeric method, and the resurvey works should integrate the control survey system with topographic map to make the data match so that it can be applied extensively. In addition, the development and integration of new technology development are also crucial to improve the power of geospatial technologies, through distributed computing ability, computer hardware development, network technique progress and other information processing technology are integrated to improve the real-time processing ability and increase the efficiency of management, it will contribute to promote the application of cadastral information linking with geospatial technologies. ■

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The complete paper with detailed references can be seen at http://www.GISdevelopment.net/magazine/years/2005/march/index.htm