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AN ESTIMATION OF THE VOLUME OF DIGITAL INFORMATION OF THE HELLENIC CADASTRE

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Abstract

Unlike many countries with a well established Cadastre, only now is Greece undertaking a project for a uniform Cadastral System for the entire country. The use for many years of inadequate data for the definition and transfer of property has created a complex confusion making the task extreemely difficult. Among the many parameters which should be determined for the efficient planning of the project for the "National Cadastre", was the estimation of the total volume of the digital cadastral information, textual (alphanumeric and legal) and graphic, which the Hellenic Cadastre is going to process, through G.I.S. and Relational Data Bases. Various layers and storage techniques of digital information are elaborated on and a detailed description of the structure of the files and their volume is given. In total it is estimated that for the Hellenic Cadastre

- approximately 30 Gbytes is the volume for the geometric information (land parcels, building, topographic details)
- approximately 20 Gbytes is the volume for textual information (land rights such as ownership, share-ownership statements, mortgages, charges, easements, seizures, claimings etc).

1. Introduction

Unlike many countries with a well established Cadastre only now is the Hellenic Republic undertaking a project for a uniform cadastral system for the entire country. The use for many years of inadequate data for the definition and the transfer of property has created a complex confusion making the task extremely difficult.

Among the many parameters which must be determined for the efficient planning of this project it was realized soon that an estimation of the volume of digital geometric and textual information which will be processed, managed and updated in real time was indispensable.

The estimation of these quantities should be actually based on the technical and legal specifications, which to a large degree is the dominant factor. The specifications drawn up by the Hellenic Mapping and Cadastral Organisation (HEMCO) for instance demand that the cadastral maps will be in digital form and on a scale of 1:1.000 for high density conurbation, on 1:2.000 for low density conurbation, on 1:5.000 for rural land and on 1:10.000 up to 1:20.000 for the rest areas.

It is obvious that the two main series 1:1.000 and 1:5.000 although they cover only the one third of the surface of the whole country, they constitute the bigger and main part of the digital geometric and legal cadastral information. It is also known, that the amount of digital information contained in each map series is independent of the methodology (photogrammetric stereorestitution, digital orthophotomaps, field surveying, digitisation of existing reliable cadastral maps) used for the data capturing. On the contary, the volume of this information depends on the technical specifications (topographic details, accuracy of the digital data to be selected, structure of the files, management and presentation of information etc).

2. Estimate of the Density of the Digital Geometric Information

The whole country has been classified into four land-types:

1. high density conurbation
2. low density conurbation
3. rural land after reallotment
4. fragmented rural land where reallotment was not applied or needed not to be applied.

The estimate of the density was achived by sample digitisation of the planimetric information, which consists of the following catefories:

- buildings
- boundaries
- other topographic details (roads, railway lines, rivers, streams, individual points etc).

A mean density value for each of the above categories and for each of the four land-types are calculated and shown in Table 1 and Table 2.

Categories of geometric information (points/cm^2)				
Land-type	Buildings	Boundaries	Other	Total
Urban	1.81±0.25	0.52±0.23	0.57±0.10	2.89±0.39
Suburban	0.83±0.27	0.46±0.11	0.45±0.24	1.74±0.38
Total				**2.12±0.28**

Table 1. Density values for the cadastral series 1:1.000

Land-type	**Average landparcel area in hectares**	**Boundaries points/cm^2**	**Other information cm/cm^2**
Area with comparatively large ownerships	1.50	0.89±0.21	0.25±0.14
Area with small ownerships	0.43	1.91±0.30	0.48±0.27
Total	0.55	1.70±0.24	0.43±0.22

Table 2. Density values for the cadastral serie 1:5.000

The values are given:

- for the scale 1:1.000 in number of points per cm^2 on the map scale, and
- for the scale 1:5.000 in number of points per cm^2 (for buildings, boundaries-streight lines, individual points etc) and in line length per cm^2 for natural not streight linear information (natural curves, topographic details).

The linera measuring unit was selected to be independent of human factor (digitising habits of the operator) and of the digitizing software used. By selecting a mean digitising step it can be easily transformed in number of points per cm^2.

The series 1:1.000 cover an area of 6.000 km^2 approximately, while the series 1:5.000 cover an area of 40.000 km^2. So, for the whole series 1:1.000 approximately 130.000.000 points are needed, while for the series 1:5.000 27.000.000 points plus 70 km line length on the map scale are needed.

In addition to the normal cadastral information an estimate of the density of elevation information, contour lines and individual height points, contained in the series of 1:5.000 is given. For this purpose the whole country was classified into three ground-types:

- mountains
- semimountainous regions
- flat areas.

The density values are given in Table 3.

Ground-type	Density of information (cm/cm^2)
Mountains	5.36±0.56
Semimountainous areas	2.95±0.60
Flat areas	1.17±0.92
Total	**3.50±0.39**

Table 3. Density values for elevation information

3. Estimate of the Volume of the Total Digital Cadastral Information

The geometric information (cadastral maps) and the legal information (attributes) are been processed in a Geographical Information System (GIS) and a Relational Data Base (RDBMS). The volume of this information is influenced by a number of factors, such as the software package for GIS and RDBMS to be used, the type of information to be selected and manipulated, the art of storing (format, simple-double precision, data compression etc). In our case, the estimate of the total volume of digital data was made according to the technical specifications of HEMCO, assuming that the ARC/INFO GIS package will be used.

The geometric information consists of three levels:

- landparcels (sites, areas of common use, streets etc)
- buildings
- topographic details (planimetry and elevation)

The structure of this information is shown in Fig. 1.

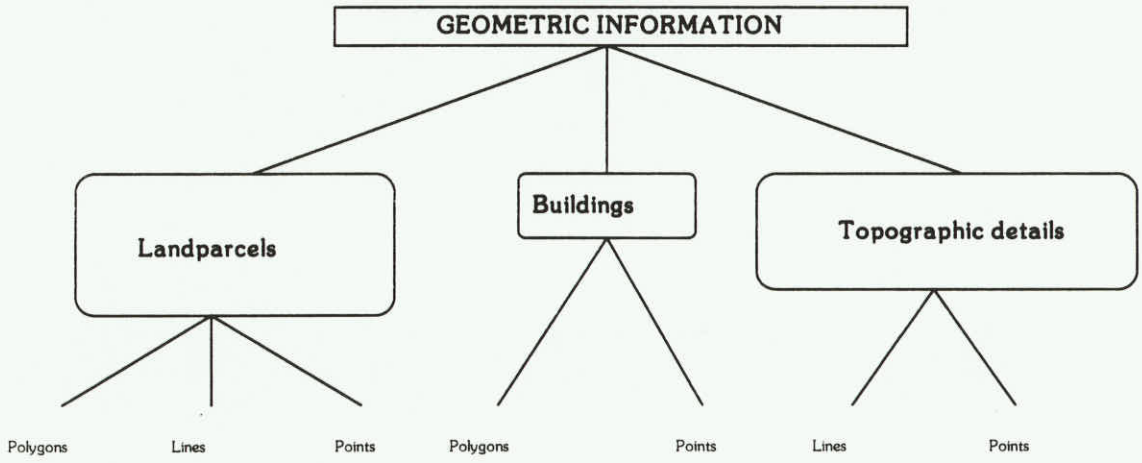

Fig. 1. Structure of cadastral geometric information

Based on the density values calculated above and on additional information such as the total number of ownnerships which is approximately 15.000.000 for the whole country, the volume of the digital geometric information is approximately **30 Gbytes** and is shown on Table 4.

Types of information	Volume per feature	Total number of features	Volume (Gbytes)
LANDPARCELS			
Urban polygons	268 bytes/polygon	9.900.000 landparcels	2.7
Rural polygons	308 bytes/polygon	6.300.000 landparcels	1.9
Linear features	212 bytes/arc	67.000.000 arcs	14.2
BUILDINGS			
(polygons)	350 bytes/building	10.000.000 buildings	3.5
PLANIMETRY			
Linear features	400 bytes/arc	2.000.000 arcs	0.8
Points	110 bytes/point	2.000.000 points	0.2
ELEVATION			
Linear features	1.750 bytes/arc	2.700.000 arcs	4.7
Points	120 bytes/point	2.000.000 points	0.3
TOTAL			**28.3**

Table 4.

Types of information	Amount of information	Character per unit	Volume (Gbytes)
Landparcel	15.000.000	117	1.8
Buildings	10.000.000	66	0.7
Appartments	84.000.000	63	5.3
Titles	101.000.000	64	3.3
Easements-Claims Mortgages-Seizures	1.000.000	128	0.2
Register of Changes	9.000.000	128	1.2
Other information			7.5
TOTAL			**20.0**

Table 5.

The legal information (attributes) is estimated based on statistical data derived from the competent Hellenic services. The total volume is estimated to be approximately **20 Gbytes** as shown on Table 5.

The scanning of additional textual information like contracts, legal documents etc, and old topographic plans for each ownership would enlarge the volume

of digital information too much. It is estimated, quite roughly, that their volume rises up to 24.240 Gbytes, which is out of thought at least for the time being.

4. Conclusions

Generally speaking, it can be said that the amound of digital information to be selected processed manipulated updated and distributed in **real time** for the Hellenic Cadastre, during its first phase of establishment, will be approximately 50 Gbytes. Twenty of them reffer to vector maps and the other 30 Gbytes reffer to attributes.

Literature

1. HE.M.C.O., 1988. "Technical Study for the Hellenic Cadastre", HEMCO edition (in Greek).
2. HE.M.C.O., 1994. "Technical Specifications for the Hellenic Cadastre", HEMCO edition.
3. Howard S., 1968. "A Cartographic Data Bank for Ordance Survey Maps", Cartographic Journal, vol. 5(1), pp 48-53.
4. Potsiou C., Badekas J., 1986. "Perspectives of Digital Cadastre", Proceedings of the 1st Workshop on "Perspectives of Hellenic Cadastre", Athens, Greece, published by the Technical Chamber of Greece, pp 425-436 (in Greek).
5. Potsiou C., Badekas J., 1989. "Digital Cadastral Mapping", Proceedings of the 2nd Workshop on "Perspectives of Hellenic Cadastre", Athens, Greece, Special Edition of the Technical Chamber of Greece (1993), pp 160-165 (in Greek).
6. Uhrig H., 1970. "Untersuchungen zum Datenumfang und Speicherbedorf sowie zur automationsgerechten Gestaltung der Zeichen fuer die Topographische Uebersichtskarte 1:200.000", Nachrichten ausdem Karten und Vermessungswesen, Series 1 (47), pp 61-73.