

Hungarian Approach to the Model of Database for Unified Land Registry

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Key words: land registry, real estate, cadastral map, database, model, standard.

SUMMARY

In Hungary a database model for unified land registry system has been elaborated based on international trends of standardizing. It has relevancies to database structure and database content, having the first with international character and the second with national one. This object-oriented relational database approach has been introduced and realized in the Hungarian practice more than 5 years, already. The database model is applied to the unified land registry (cadastre system) containing the description/legal part of the data and graphical one. However this approach may be extended over and used to all appropriate data of land administration considered by the WPLA. The paper will present this Hungarian approach and will be showing its use for the countries with a special emphasis to the undeveloped and developing ones.

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1. SHORT OVERVIEW OF LAND AFFAIRS IN HUNGARY

Hungary has an area of 93 029 km² and 10.2 million inhabitants. In the middle of the 90's there were over 7 million property records and 55 000 cadastral maps. During the political and economical changes in the 90's, a land compensation programme has been enacted whereby land areas are redistributed to former owners or other compensation claimants. So, an effective 2.1 million new land parcels has been created on more than five million hectares. All these have been managed, auctioned, divided, set out, and the results assimilated into the Cadastre System. This situation required prompt activities, modernisation and computerisation of Land Offices network in the last decade. Now new land tenure trends and voluntary land consolidation procedure started – the legislative introduction of theirs are expected.

2. REAL ESTATE REGISTRATION AND CADASTRAL MAPS AS THE CADASTRE SYSTEM IN HUNGARY

There have been land book, land registration and cadastral maps operating in Hungary for over 150 years. This system was totally based on paper records consisting of cadastral maps (boundary information) and property sheet records, which record the property description, ownership information, and any financial or other burdens on the property (i.e. the legal and administrative records). These records have continuously been maintained and were unified in 1972 by the Act on Real Estate Registration. Later on modernized legislation become in force by the Act LXXVI (1996) on Surveying and Mapping and the Act CXLI (1997) on Real Estate Registration.

The modernised, already complex cadastre system (often called unified real estate registration) consists of:

- Real estate registration sheets the parcels each having a unique parcel number in a given settlement and certain details are recorded on the „Property Sheets”. Property sheet consists of three parts: Page #1, #2 and #3
 - Page 1. Descriptive data (parcel number, address, area, cultivation, soil quality, etc)
 - Page 2. Titles i.e. data relating to the ownership (name, birth, address, etc.)
 - Page 3. All the other titles and deeds (mortgages, restrictions, easements, etc.)
- Real estate registration map, which is identical to the cadastral map and serves also for land surveying purposes.

3. LANDS AND MAPPING SECTOR IN HUNGARY

Recently, for registration of land parcels and other real estates (e.g. buildings), a full cadastre system is in force in Hungary, identical with the concept introduced by FIG. It is a unified, multipurpose legal system, integration of the cadastral maps and the registration records

including the traditional Land Records (Grundbuch). The Hungarian Cadastre System is operated by the District Land Offices of the counties and the Capital Districts Land Office of Budapest of the Civil Lands and Mapping Administration. (See Fig. 1.)

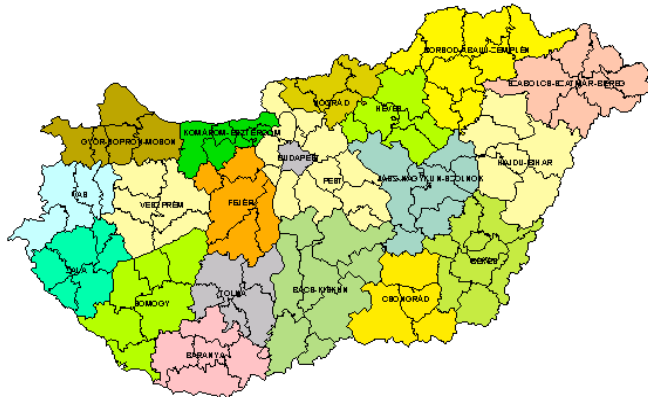


Fig. 1: County Land Offices and District Land Offices, Hungary

3.1 Structure of Lands and Mapping Administration

The structure of the Lands and Mapping Administration of the Ministry of Agriculture and Regional Development is shown in Fig. 2. There are some 5000 employees with an annual budget of around 10 billion HUF (40 million ECU). The District Land Office computer systems are upgraded to enable the Property Sheet records (100 % loaded) to be integrated with the digital cadastral maps that are now becoming available. In the 115 Districts outside Budapest, this is known as the TAKAROS system. In the Capital District Land Offices (all 23 of which are physically in the same building) the Property Sheets are loaded into a similar Oracle database. PHARE funding has supported both of these projects. The cadastral maps of Budapest are being loaded into a separate system funded under the Swiss-Hungarian bilateral aid programme.

The Administration is divided into four separate levels to suit these requirements which are:

- DLM: General management, Legalisation, Strategy Planning, Project Management and auditing of the Land Offices.
- FÖMI: Institute for Geodesy Cartography and Remote Sensing performs tasks of nationwide competency of the Administration, serves as a background institution of DLM and supports the activity of Land Offices as well as provides thematic, methodical and IT developments for the institutional network of the Administration
- CLO: Managing the DLOs, Local Planning, Local Project Management, Auditing of DLOs, Technical and Legal Support to DLOs, Marketing maps, and accepting new maps
- DLO: Maintenance of the legal titles, the cadastral maps, and the land use and classification and valuation data.



Fig. 2: Organisational structure of the Hungarian Lands and Mapping Administration

3.2 The Role of Lands and Mapping Administration

In Hungary, as in many other European countries, the Government is the guarantor of title through the act of registration of property which records all required legal, administrative, financial and physical description information within. The map records are tied to the legal and property records by means of a unique identifier (the parcel number). In Hungary, this system is largely in place, and coupled with the decentralised nature of the Hungarian system, the system provides the large scale basis for the collection and recording of other land related data (land use and classification, land protection) and thus forms multipurpose cadastre. The structure of the services is shown in Fig. 3 below.

The system has to fulfil the following national requirements for the interest of sustainable development, namely, providing security of titles, supporting the Mortgage Institution, supporting Land Compensation and Privatisation, supporting Land Consolidation procedures, supporting and enabling the land tenure actions, stimulating the Land Market, providing Data for Taxation Purposes, providing Data for Urban and Regional Planning, providing Data for Utility Registration, providing Data for Agricultural Planning, providing Data for other National Services (e.g.: Forestry, Hydrology etc.), providing Data for the National Statistics, providing Data for the Local Authorities, providing „Positive” registration and a guarantee of the registered data.

Users and their cooperation	Value Added Services: Land Related Statistics, Thematic Maps		
	Land Policy: Land Tenure, Land Protection, Land Consolidation, Melioration		
	Land Registration: Titles, Facts and Burdens		
	Land classification & valuation: quality scoring gold crown		
	Land use: cultivating, urban use		Land Coverage: EU nomenclature
	Remote Sensing: Source Data, Services		
	Cadastral Maps	Topographic Maps	Geographic Maps
	Technical Documentation: Specification of Work, Sketch Maps, etc.		
	Geodetic Service: CP Network, Projection, etc.		
	Data capturing and its		

Fig. 3: Services by the Lands and Mapping Administration

4. NATIONAL CADASTRE PROGRAMME

Approximately 60 000 cadastral map sheets cover the area of Hungary at scales from 1:1000 to 1:4000. A large part of the sheets are in different projections, mapping systems and datum (stereographical, cylindrical etc.).

After the political and economical changes the land privatisation affected more than half part of the country (5.6 out of 9.3 million hectares). All efforts have been made to keep the old cadastral maps up-to-date during the land privatisation process. From the other side, a nationwide map renewal (data capture) programme was worked out to realise the unification and updating the existing systems within framework of the National Cadastral Programme (NCP). New, EU-conform professional standard and instructions prepared by FÖMI for digital mapping were issued by the Hungarian Body of Standardisation and the DLM of MARD.

In 1996 the MARD founded a National Cadastral Programme Public Benefit Company in order to implement the NCP and handle the credit matters, which is guaranteed by the Hungarian Government. From professional aspects, the implementation of the programme is directed by the Department of Lands and Mapping of the MARD. Hungarian seated professionals and surveying and mapping companies are contracted by the NCP Public Benefit Co. to carry out the digital cadastral survey in standardised form and the digitisation for rural areas. In this process, the Hungarian Public Procurement Act must be applied.

Recently, the digital cadastral survey in standardised form is carried out on 500 thousand hectares (6% of the area of Hungary), as well as 2300 thousand hectares of rural areas (25% of the area of Hungary) are digitised in near-standardised form.

During 2002 and 2003 the NCP Public Benefit Co. has successfully performed digitisation of cadastre maps of rural areas in a pilot project over 1.9 million hectares to support the Integrated Administration and Control System (IACS) to be introduced at the time of the EU-accession of Hungary.

The results of large amount of digital cadastral maps are expected to be integrated with land

registry data in the database of the Land Office IT-systems called TAKAROS to make the cadastral system alive in computerised form.

The technical and financial documents of the NCP have been elaborated focusing on the following items:

- Accelerating the data entry of the land registration records,
- Continuing the cadastral mapping project,
- Providing geometric template for land registration and for a wide range of applications,
- Education, training and management,
- The implementation of additional planned actions, having impact on the NCP is scheduled using a priority scenario,
- In 2003 a revised program a NCP has been ordered by government: all the analogue cadastral maps of Hungary must be vectorised during 2 years for the rural areas and during 4 years for the built-in areas. A governmental credit of 9.8 Billion HUF are available for this purpose.

5. THE MODERNISED LANDS AND MAPPING ADMINISTRATION

Over the past decade, the DLM with the aid of EU PHARE Programme and, to a lesser extent, of the Swiss Government, as well as based on Hungarian government budget considerable investments has been made the modernisation of the infrastructure for Lands and Mapping Administration.

5.1 Steps of the IT Strategy implementation

The overall TAKAROS (Térkép Alapú Kataszteri Rendszer Országos Számítógépesítése – Countrywide Computerisation of Map Based Cadastre) concept has been gradually developed. At the beginning of the concept development, it covered the Country IT Systems only. For technical and financial reasons, the Capital System was considered separately. Having defined TAKARNET as part of TAKAROS, the IT concept became unified. The CLO implementation step of the original TAKAROS concept has been extended to include harmonisation of both systems. Interfacing between the different parts of TAKAROS has become a basic element of the TAKARNET and META. *Actions were:*

- Installation of computerised Real Estate Registration system (property sheet maintenance part) in decentralised form in the District Land Offices (1994) and in the Capital Districts Land Office (1996), connecting more than 2500 PCs in LAN supported by PHARE.
- Loading of all real and land property sheets data (about 7.5 million properties) into the system (1994 - 1997).
- Installation of a TAKAROS (TérképAlapú KAtaszteri Rendszer Országos Számítógépesítése – Countrywide Computerisation of Map Based Cadastre) is completed by the end of June 2000 in all District Land Offices. A version of TAKAROS called BIIR is installed in the Capital Districts Land Office.
- Completing an intranet type wide area telecommunication network TAKARNET (TAKAROS NETwork) for countrywide data access/supply, by connecting the Land Offices with each other and with FÖMI and DLM (1997) as well as with external users (banks, public notaries, local governments etc.), 2002.

- Reconstructed version (2002-2003) of the BIIR software and database at the Capital District Land Office is now active.
- The introduction of the TAKAROS/TAKARNET systems gives opportunity for the Land Offices to transform their information service requirements into proactive suppliers of structured spatial information. The County Land Offices are under development to be regional centres for spatial information (this involves development of marketing skills, product development, project management, and the definition of goods and services to be supplied).
- Development of County Land Office's META system funded by EU PHARE Programme (MEgyei TAKAROS – County TAKAROS) and co-financed by MARD. In the framework of META – among others – a Management Information System for monitoring, analysing, controlling and directing all of the activities of the Land Offices is to be finished in 2003.

5.2 On the TAKARNET System

TAKARNET is an intranet-type network, which connects the institutions of the Hungarian land administration (MARD, Land Offices and FÖMI) and provides data supply for external users on Internet.

The network has hierarchical contexture. The central access point at FÖMI set up the data service. The TAKAROS data-servers of the District Land Offices and the identical BIIR data server of the Capital Districts Land Office are hierarchically connected to the central access point. The external users can reach the data through this network at the central access point. The physical contexture of the network is shown on Fig. 4.



Fig. 4: The physical contexture of the TAKARNET

Services of the TAKARNET for the Land and Mapping Administration are: electronic mail, supporting of the work in land offices, acceleration of the communication.

The following services of TAKARNET are provided for external users: information about the

property sheets, map copies.

The planned external users are: notaries, local authorities, banks, lawyers, property agencies, public administration.

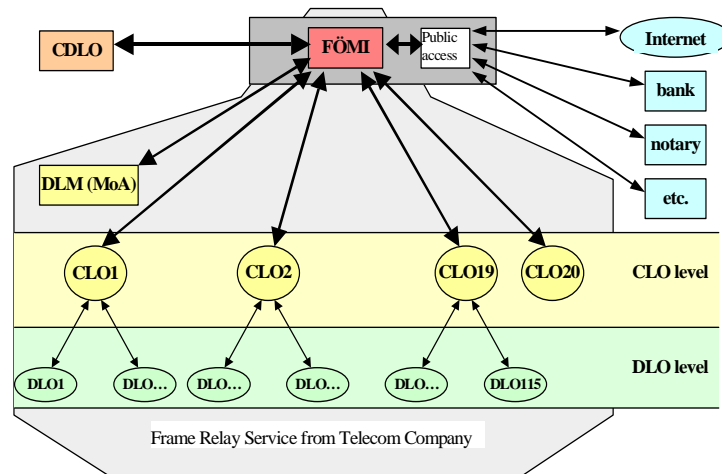


Fig. 5: Logical hierarchy and mode of the access to the network

The service is available in the whole country. External users can use the network after the ministerial decree on data supply and fees entered into force in May 2002.

5.3 On META

Megyei TAKAROS (County TAKAROS). This is the final step of the overall TAKAROS development. META enables CLO to provide technical support to DLO such as help desk and background data processing. META completes the missing interfaces of the overall TAKAROS system. META introduces a Management Information for the sector. It is finished recently in 2003.

Major Strategy aims to be completed:

- Increasing the reliability and safety of the DLO by technical support, archiving and being able to replace any DLO in case of disaster
- Supporting the Land Mortgage Institute
- Increasing potential income by being able to create new GIS data products
- Supporting Local Authorities by providing access to GIS data sets
- Raising the National IT level of awareness and application by encouraging technical developments built upon the new services of the different sectors
- Supporting National Mapping activities by providing Automated Cadastral Maps. Quality Controlling and Accepting data for the Generation of TAKAROS DLO data sets with replacement map data
- Supporting EU membership by providing land use and land qualification monitoring features
- Stimulating land market by providing thematic maps and support for Land qualification and Valuation

- Supporting Land Tax by creating thematic GIS data sets and making them available by Intranet.

6. LAND USE

In Hungary, the property reform – started in 1990 – has resulted in a great increase in the number of properties and parcels. From the previously homogeneous large estates, hundreds of thousands of small parcels were created. The use of the arable lands mostly does not coincide with the proprietary rights. For that reason, the most important provision of the amendment to the Act on Arable Land was the introduction of the land use registration on 1st January 2000.

The main ordering principle of the land use registration and that of the land registration are different. In land registration, the property is the basic item – it means that all additional data are gathered into groups around these items. The land use registration is managed in each District Land Office for its territorial competence. The land use sheet contains all the parcels of a land user on the territory of the given Land Office. The land use sheet consists of two parts. The first part contains the land user's data, the second part contains the used land's data. No registration of land use is required for a land property with a size less than 1 hectare.

The land use registration system called FÖNYIR has been elaborated and installed at the District Land Offices by FÖMI in 2000. From this year on, the land users have been registered at the District Land Offices. The task of the land Office network for 2002 are as follows: to register the changes continuously, to detect those who failed to register and to increase the correctness of the registration.

7. LAND VALUE IN HUNGARY

In Hungary, the land value system introduced in the second half of the 19th century called Golden Crown system is still in power. At the time of its introduction, this system had served for its original purpose. Recently, the system and its method became old fashioned, however, it is still in power and use. The land parcels are registered by District Land Offices, using the Golden Crown system. Its survival might contribute to the fact that the arrangement of the land ownership conditions, the compensation by land, the re-allotment of the land to the co-op-members on basis of the original property value and, in general, the privatisation needed the value of lands in old Golden Crown system, since it is operating as a connecting tie between the past and present times. The Golden Crown system indicating the quality of the land highly promotes the rearrangement of the property conditions. Consequently, at least till completion of that rearrangement, the validity of the Golden Crown system should be maintained.

8. LAND PROTECTION AND LAND UTILISATION

Arable land is one of Hungarian nation's natural resources, which cannot be substituted, but should be improved from time to time. Important economic interest is involved in its

protection and its adequate utilisation. One prominent field among the activities of Land Offices is to perform tasks connected with the protection of arable land and with its proper use.

8.1 Land Protection

Arable lands can be used for purposes different from that of agriculture only by leave of authority. To the utilisation of arable lands for industry, mining, water conservancy, transport, community development and/or other purposes, a permission has to be granted by the Land Offices.

However, the utilisation of arable land under permission does not provide preventing force all by itself and further, the areas should be compensated which inevitably have to be used to investments. Therefore, in case of non-agricultural utilisation of arable land, besides the permission, a land protection fee should be paid by the user, too.

8.2 Land Utilisation

As an undesired by-product of land privatisation carried out in the last decade, scattered property patterns have been formed in our country, e.g. properties of arable lands belonging to a single landowner dispersed at 5-10 different field units, far from each other. This fact is very disadvantageous from the point of view of economical production. To overcome this situation, the present legislation offers one possibility: spontaneous land exchange. Arrangement of such exchanges, especially in case of several property owners, needs much skill and proficiency. Therefore, since the possibility is legally given, those intending to exchange their lands would rather do request the assistance of the competent land office.

In connection with land utilisation, Land Offices have a dual task. One of them is checking the obligations of farming the land, the other is promoting land consolidation by means of spontaneous land exchanges.

9. LAND CONSOLIDATION AND LAND TENURE

Both the Land Consolidation and Land Tenure are very impacting factor in the sustainable development procedures also in Hungary:

- After the compensation period a lot of small parcels in rural area exist now. Voluntary land consolidation activities started in Hungary, for that reason. Their have been pilot project to formulate the technical, organisational, social and legislative approach. On this base a land consolidation act is under preparation. All the IT developments and the cadastre system are suitable to handle this procedure.
- The sustainable development is touched at highest level by policy making about the lands. The relevant land tenure with its agrarian, social, political and economical aspects is planned to be supported by a project in Hungary, initialised by FAO to manage National Database on Land Tenure based from one side on the existing and developed respectively also for that purposes Hungarian Cadastre System.

10. LEGAL ISSUES

There have been a number of changes in the legislation relating to land issues in Hungary to provide a framework for the land privatisation and to support the computerisation of land records and the adoption of digital technology. It was a good opportunity to examine the existing legal framework in terms of potential restrictive practices: to simplify the regulatory framework and review the legal code; review the credit arrangements and resolve the issues concerning copyright and ownership. Over the Act on Surveying and Mapping and the amendment decree to it, mentioned in Chapter 1, the following laws on land affairs are noteworthy in the present Annual Report:

10.1 Acts

- Act LXXVI. (1996) on Surveying and Mapping
- Act CXLI (1997) on Real Estate Registration
- Act XLVIII. (1999) amending Act LV. (1994) on Agricultural Lands. This act stipulates for the registration of users of land of over 1 ha holdings in the land offices.
- Act CXVI (2001) on the National Land Fund. The aims of the law include the rational management of state-owned lands, improved land tenure and land use conditions, as well as support for the development of viable family farms and for those whose living is based on farming.

10.2 Decrees and Directives in Selective Approach

- Directive No. 1/1998. (FVM.É.19.) FVM. Subject: on co-operation of institutions participating in the National Cadastral Programme (MARD)
- Decree No. 109/1999. (XII.29.) Enacting clause of Act CXLI. (1997) on Real Estate Registration, MARD.
- Government Decree No. 184/1999. (XII.13.) on The detailed rules of registration of land users using lands over 1 ha holdings in the Land Offices.
- Decree No. 41/2002. (V.14.) on the administration service fee for supplying certain land registration data available through query from computerised database and on data supply through data transfer lines (MARD).

11. STANDARD ON DIGITAL BASE MAP

MSZ 7772-1:1997 Digital Maps: Part one: Digital Base Map Conceptual Model. This standard is referred to in Hungarian as "DAT-Standard" by its Nick-name.

The DAT Standard gives prescription of the following main groups of information:

- Cadastral and Real estate data
- Natural and Man-made features

Prescriptions are formulated as adequate to resolution available in scale band 1:1000–1:4000. The data handling unit is the settlement.

The international GI structural standard used too derive the Hungarian map data base content standards were those of CEN and ISO which got readiness to be used and which have been

coinciding to each other, namely: pre-standards on spatial schema, quality, metadata and position.

11.1 Description of the Conceptual Model of the Dat Standard

The following chapters of the DAT Standard are describing the conceptual model:

- Terminology,
- Data model of the digital base map,
- Position (spatial referring): Map projection system (Hungarian EOV), Reference system (Hungarian Datum, HD-72), Height system (Baltic sea level, ortometric),
- Classification of objects and thematic structure,
- Spatial schema: Geometrical primitives, Topological primitives, Spatial view, Explanatory texts,
- Attributes,
- Relations: between nodes, between edges, faces and rings,
- Data quality: Source, Extent of application of data, Quality of geometric data, Quality of attribute data, Actuality, Completeness, Consistency of data, Technology for data collection, Data protection, Verification.

11.2 Structure and Object Classification of Digital Base Map Standard

The digital maps are represented in object-oriented relational database. The specific objects are described by their attributes, relations and data quality parameters.

At conceptual model level the specific objects are represented by their generic objects. Those objects for which the attributes are common are grouped into one object group. The object groups having common attributes at higher level are grouped into one object classes.

Three object types are distinguished by its geometry: point, line, surface objects. The objects are managed by their topology such that fulfilling the full-topology requirement. The topology elements distinguished are: node, edge and face. The nodes are divided into more specific types.

By geometry, the digital base map databases are 2-dimensional with planimetric coordinates. The heights are or can be given as attributes.

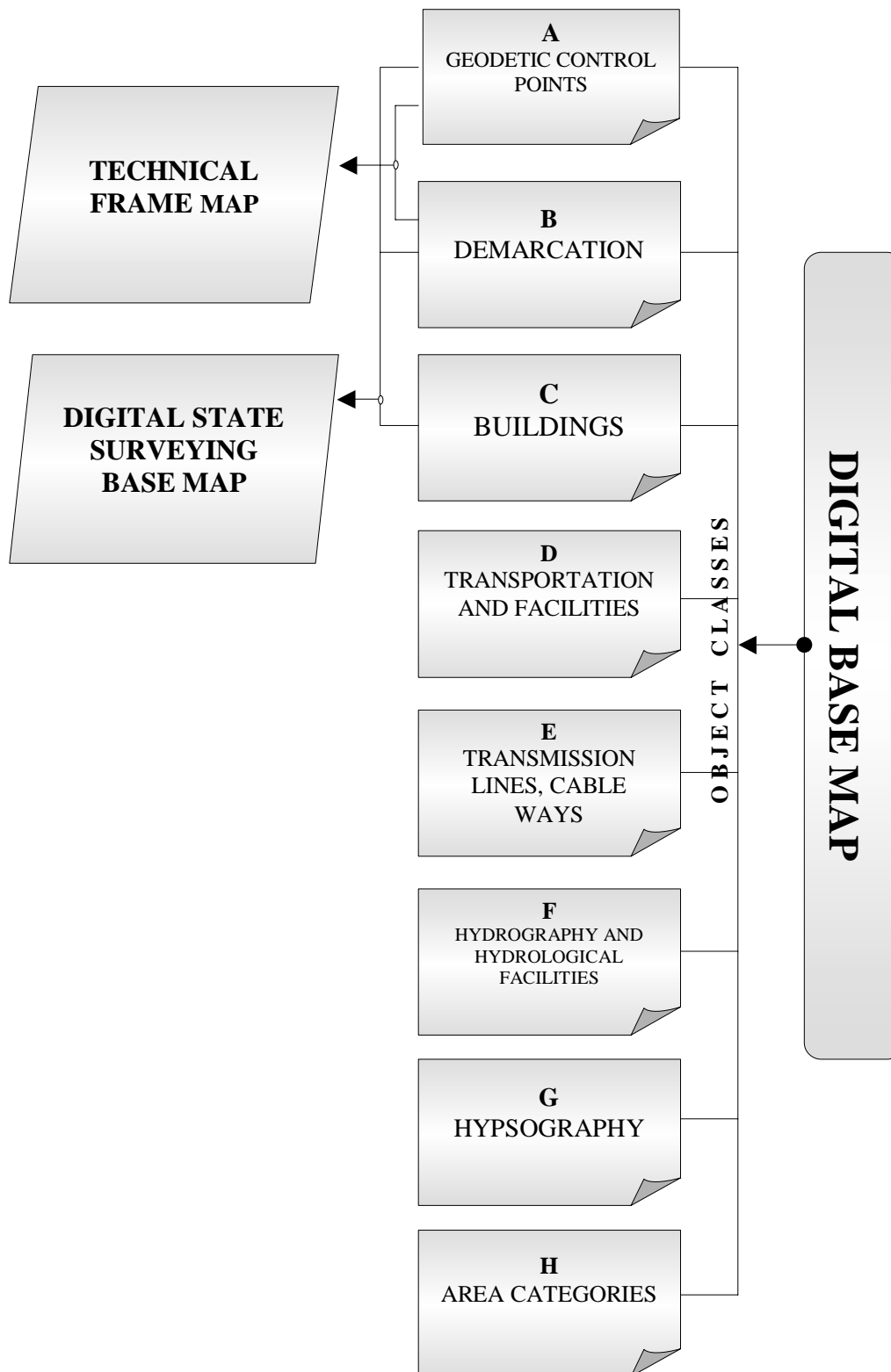
The attributes, relations and quality parameters are defined in the standard as generic. Their values are given in supplementary tables.

11.3 Physical Model of the Digital Base Map – Technical Regulation

- DAT1_ Instruction on "Planning, producing, renewing, documenting, checking, quality-checking, certifying and state acceptance of Digital Base Maps". Budapest, 1996.
- DAT1-M2_ Supplement Instruction on "Structure, data tables, exchange format and handling rules of Digital Base Maps". Budapest, 1996.
- DAT1-M2. Supplement Instruction on "Legends for printing the Digital Base Maps". Budapest, 1996.
- DAT1-M3_ Supplement Instruction on "Checking and certifying the inner consistency of

- data of Digital Base Maps". Budapest, 1996.
- DAT2. Instruction on "Digitising the multipurpose analogue cadastral maps and its quality checking." Budapest, 1996.
 - DAT2-M1. Supplement Instruction on "Transformation between different projection systems used in Hungary, with special emphasis on transformation to the regular projection system EOVI." Budapest, 1996.

Thematic Structure, Digital Base Map Standard MSZ 7772-1:1997



Object Classification, Digital Base Map Standard (MSZ 7772-1:1997)

A Geodetic Control Points

- AA Horizontal and 3D geodetic control points
- AB Vertical geodetic control points
- AC Survey points

B Demarcation

- BA Administrative unit boundaries
- BB Administrative sub-unit limits
- BC Parcels I. (public domain)
- BD Parcels II. (non-public domain)
- BE Sub-parcels and branches of cultivation
- BF Quality classes of arable land

C Buildings

- CA Buildings
- CB Accessories of buildings
- CC Fences, sustaining walls
- CD Ground objects, special buildings
- CE Statues, monuments, memorial places

D Transportation and facilities

- DA Identification points of transportation facilities
- DB Roads and facilities of built-in areas
- DC Roads and Facilities of rural areas
- DD Railways and fixed track ways
- DE Facilities of air traffic
- DF Construction works (I.)
- DG Construction works (II.)

E Transmission lines, Cableways

- EA Axis of conduits, cableways
- EB Construction works of conduits, cableways

F Hydrography and Hydrological Facilities

- FA Flowing and still waters
- FB Water public utilities
- FC Hydrological engineering structures

G Hypsography

- GA Contour lines
- GB Relief configurations
- GC Digital terrain model

H Area Categories

- HA Areas of data capture actions
- HB Base map handling units
- HC Special areas

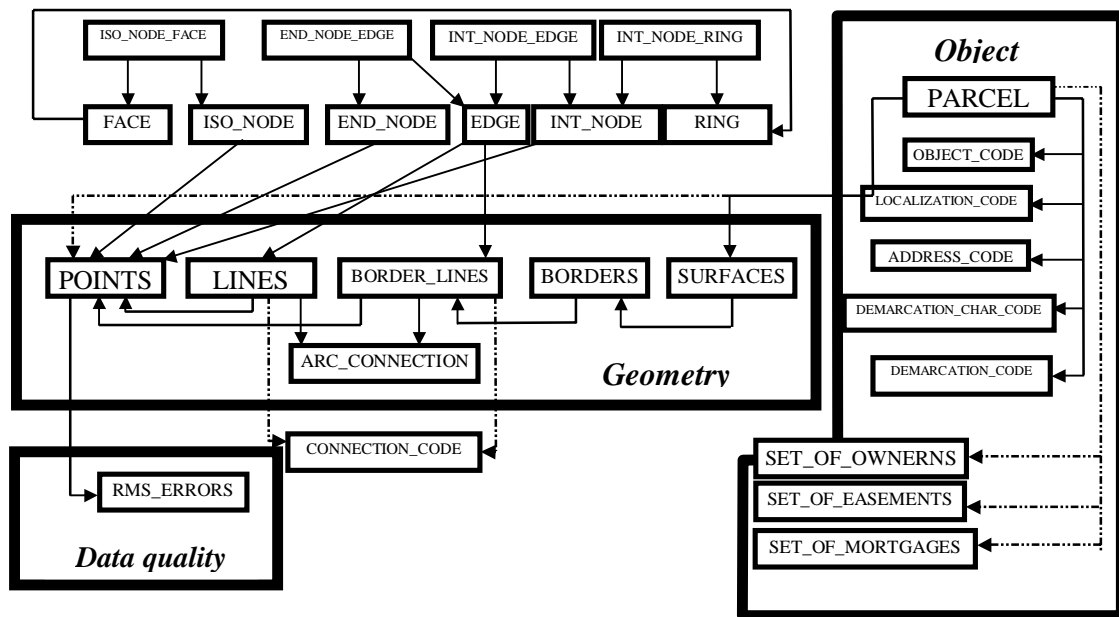
Example Attribute Table – Digital Base Map Standard MSZ 7772-1:1997

Code of attribute table: ATTRBC

ATTRIBUTE TYPES OF PARCELS (PUBLIC AREAS)

<u>Identifier</u>	<u>Name of the attribute type</u>
1.	Object identifier number
2.	Code of object type
3.	Geometry description identifier of the object
4.	Parcel number
5.	Postal address
6.	Name of en-framing settlement
7.	Code of en-framing administrative subunits
8.	Code of area type
9.	Volume of registered land (m ²)
10.	Land valuation value
11.	Market value of the parcel when acquiring
12.	Economical sector code
13.	Legal type code
14.	Easement descriptor
15.	Legal status descriptor
16.	Data relating to the legal title of acquiring
17.	Data relating to charges, mortgage
18.	Line of cultivation (also area out of cultivation)
19.	Name and address of the owner organization
20.	Property share of the owner organization
21.	Name and address of trustee or land user
22.	Legal status of demarcation procedure (preliminary, final)
23.	Date
24.	Registry number of the decision
25.	Form of change (e.g. union, sharing, easement)
26.	Storage address of sketch of updating
27.	Date of abolition
28.	Code of visualization legend
29.	Identifier of the related unit of data capture action
30.	Centroid of the parcel (x, y [H])

Description of object in DAT



BIBLIOGRAPHICAL NOTES

Szabolcs Mihály

Academic experience: Dipl. Photogrammeter-Surveyor (Institute of Geodesy, Ariel Survey and Cartography, Moscow, 1967), Doctor Tech. (Budapest Technical University, 1982), Ph.D. degree (Hungarian Academy of Sciences, 1981).

Practical experience: Satellite geodetic techniques and GPS, elaboration of satellite geodetic adjustment software systems, elaboration and nationwide harmonisation of the Hungarian “Digital base map” standard and “Digital topographic map database” standard, coordination and successful realization of numerous national and international R+D project, database modelling, National Spatial Data Infrastructure, coordinate system transformation.

Publications: lecture notes, monographs, more than 90 papers published in proceedings and registered journals, similar amount of internal reports, a big part of it on GIS and digital cadastre.

Recent membership: Geodetic Scientific Committee of HAS (sub-commission chairman), Chairman of GI Standard’s WG of Hungarian Office of Standards, Representative to Eurogeographics, Hungarian representative to FIG Commission 3.

Recent position: Director, Institute of Geodesy Cartography and Remote Sensing, Hungary.

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