The Cadastral Geodatabase Modelling in Poland, Applying Computer Aided Software Engineering Tools

Jarosław BYDŁOSZ and Piotr PARZYCH, Poland

Key words: ArcGIS, ArcCatalog, cadastre, prices' and values' register for real estates, XMI, XML, UML.

SUMMARY

This paper concerns cadastral geodatabases modelling, applying CASE (Computer Aided Software Engineering) tools, in Poland. The systems managing land information in Poland are outlined in the beginning of this paper. There are two of them, the Ground and Building Cadastre and the Land Register. Authors' chief attention went towards the prices' and values' register for real estates that is the important part of ground and building cadastre.

Scientific researches described in this article concern the prices' and values' register for real estates geodatabase modelling using CASE tools. This works have been performed as follows. The prices' and values' register for real estates schema (including all objects' attributes) given in technical instruction G-5, was created with UML (Unified Modelling Language), using Microsoft Visio. Then the tools destined for geodatabase building accordingly to ArcInfo UML model were applied. The resulting model includes objects having spatial reference (feature class), objects not having it (object class) and relationships among them. The semantics of this model was checked then. The prices' and values' register model that is semantically correct and corresponding to ArcInfo UML model was exported to XMI (XML) format. Then XMI file was imported into ArcCatalog, which is part of ArcGIS system. During XMI file import into ArcCatalog, the geometry type (polygon) was set for feature class objects. Such a resulting geodatabase representing the prices' and values' register for real estates is ready for filling with data and possible for further processing with other computer programs managing databases.

The Cadastral Geodatabase Modelling in Poland, Applying Computer Aided Software Engineering Tools

Jarosław BYDŁOSZ and Piotr PARZYCH, Poland

1. SYSTEMS OF REAL ESTATES INFORMATION REGISTRATION IN POLAND

Nowadays, there are two systems for real estates data collecting in Poland. They are the Land Register and the Ground Cadastre. The polish Land Register captures, keeps and reveals information concerning legal objects. This information generally concerns description and designation, rights, rights established for somebody else's thing and receivables (including mortgage). The Land Register's objects in Poland are mainly real estates.

The Ground and Building Cadastre, first of all consists of cadastral objects' spatial description, its attributes, values and corresponding official documents. The cadastral objects are land parcels, buildings and flats (if independent estates). The most common cadastral objects are land parcels. For parcels, apart from spatial description, there are data concerning land use type and soil class. For buildings, there are data concerning its functions, technical parameters and references to parcels on which the building is situated. For flats, there are also specifications of rooms belonging, area and references to building the flat is situated in.

The data that make the Ground and Building Cadastre in Poland are basis for spatial planning, tax calculations, real estates' identification in the Land Register, public statistics, real estates management and European Union subsidies for agricultural and horticultural production.

General rules for surveying and cadastral works are defined by The Act – Surveying and Mapping Law [Act, 1989]. Chapter number four of this act concerns ground and building cadastre. The outlines concerning cadastre including the prices' and values' register for real estates (RCiWN) are defined by The Order of Ministry of Regional Development and Buildings [Order, 2001]. The detailed outlines for establishing and managing cadastre are given in The Technical Instruction G-5 [Instruction, 2003].

2. THE PRICES' AND VALUES' REGISTER FOR REAL ESTATES

The prices' and values' register for real estates (RCiWN) is the part of ground and building cadastre. According to the order of ministry of regional development and buildings, county chief is in charge of prices' and values' register for real estates. Real estates' prices derive from authenticated deeds. Real estates' values established by estates' expert come from valuation records, for its extracts are sent to cadastre.

The following data are recorded in the prices' and values' register:

- Real estate's address,
- Numbers of parcel being estate's components,

- Estate's type,
- Estate's area,
- The date of authenticated deed signing or the date of real estate valuation,
- Other data concerning real estates.

The technical norms of establishing and managing of prices' and values' register for real estates are comprised in technical instruction G-5. According to instruction G-5, the main source data for register's values' records are extracts from valuation records – mentioned in The Act – in case of Real Estates' Management [Act, 1997]. The master maps, technical infrastructure cadastre, local spatial plans are additional data sources for prices' and values' register. The technical instruction G-5 also defines the detailed range of information managed in the register's prices' records, register's objects description and its data structure in SWDE format [Bydłosz, Parzych, 2007].

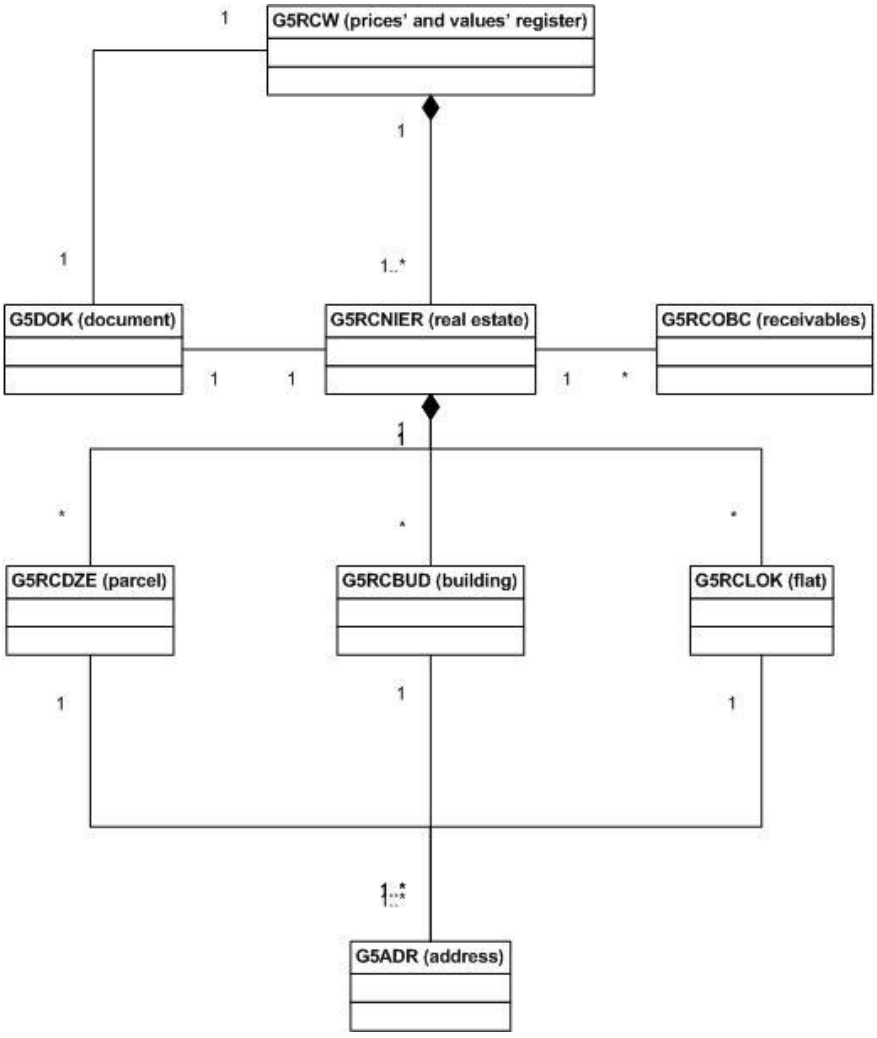

Fig. 1. The prices' and values' register objects and relationships among them.

As it is mentioned above apart from information concerning real estates' location and ownership, the prices' and values' register for real estates not only includes information on estates' technical and functional parameters (for buildings and flats), but estates' transaction prices and estimated values as well.

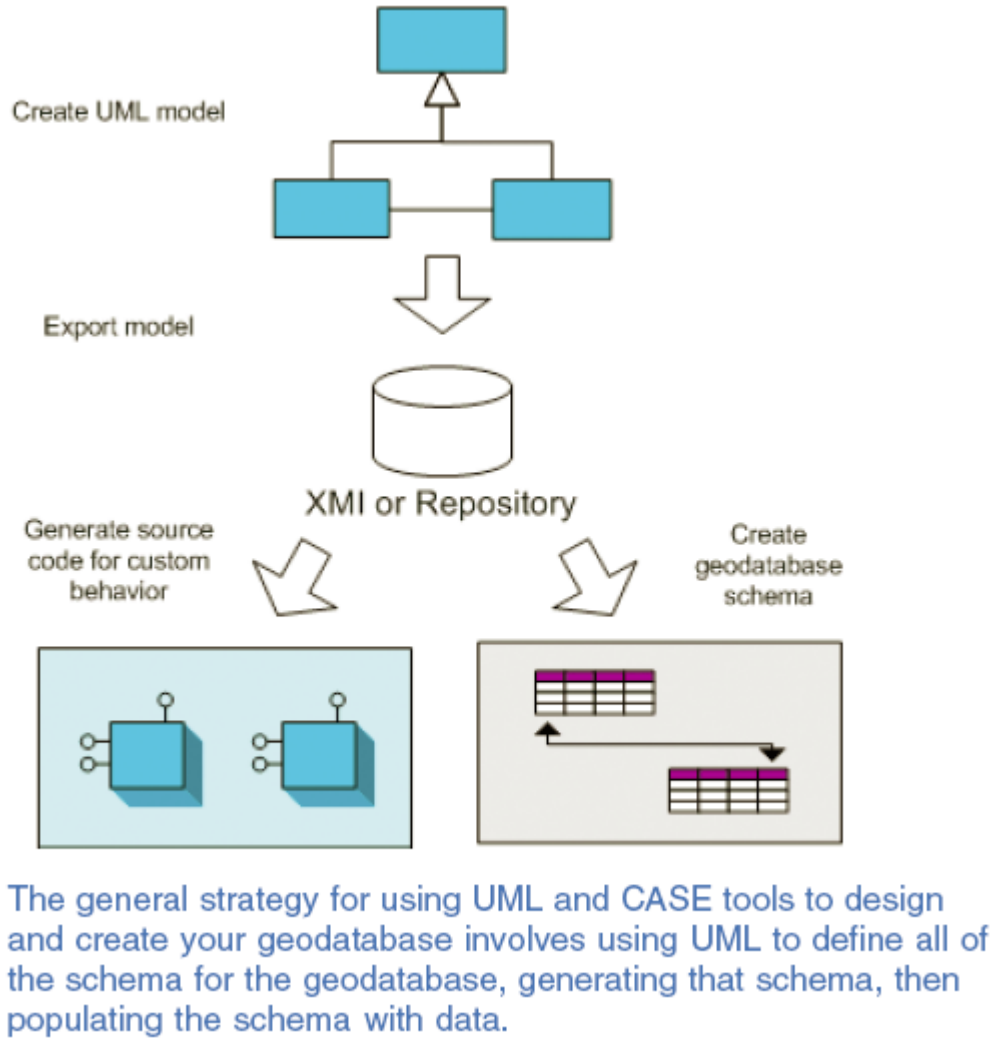

Fig. 2. The schema of geodatabase creating, applying CASE tools (Perencsik, 2004).

The relationships among the prices' and values' register objects are shown at fig.1. The attempt of the prices' and values' register modelling was made in this work. It was performed applying Computer Aided Software Engineering (CASE) tools. The procedure of such a modelling described in [Perencsik, 2004] was applied there (fig. 2). The modelling overall procedure consists of three following stages:

- The register's database schema in UML notation building,
- The database export into XML/XMI format, including model check,
- The database automatic creation.

3. THE PRICES' AND VALUES' REGISTER DATABASE IN UML NOTATION

UML (Unified Modelling Language) is a graphic modelling language enabling real world's object-oriented visualisation and documentation. UML is used for different systems' description in various aspects of human activities, for example for database designing. The great virtue of UML is the possibility of multiple optional UML schemas' modification. UML is accepted as the formal language for model and schemas description in ISO 19100 norm series, concerning geographical information.

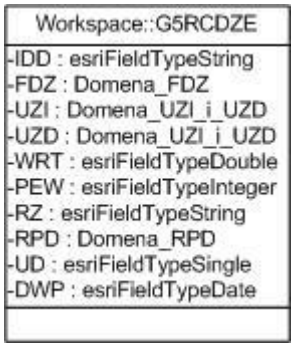

Fig. 3. The example of object – land parcel (G5RCDZE), including its attributes.

Microsoft Visio 2003 software was applied for the prices' and values' register modelling and the *Arc Info UML Model* template distributed by ESRI company was used there. The first stage of this work was creating the prices' and values' register general model, according to instruction G-5. Then register's attributes were added to its objects to create detailed model. The domains (*CodedValueDomain*) were created for attributes having specific values. The field types according to ESRI notation were defined, for other attributes. The example of land parcel object (*G5RCDZE*) is shown at fig. 3 and the *Domena_UZG* domain (defining land use) is shown at fig. 4.

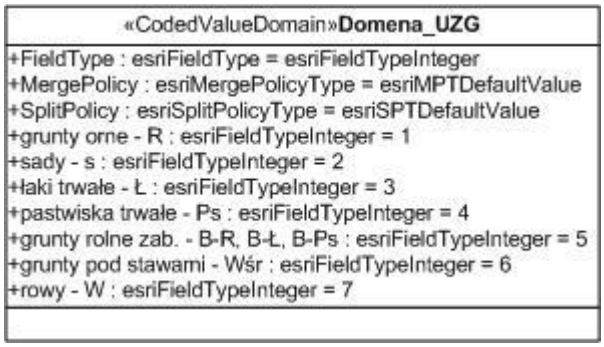

Fig. 4. The domain *Domena_UZG*, defining land use attributes.

The next step was defining objects correspondingly to ArcGIS rules. We can generally distinguish two types of objects in ArcGIS. They are of object class and feature class. Object class is a table in the geodatabase that stores nonspatial data. In the prices' and values' register they are for example address (*G5RCADR*), document (*G5RCDOK*) or flat (*G5RCLOK*). Feature class is the collection of features with the same type of geometry and the same attributes in common. They are for example parcel (*G5RCDZE*) or building (*G5RCBUD*).

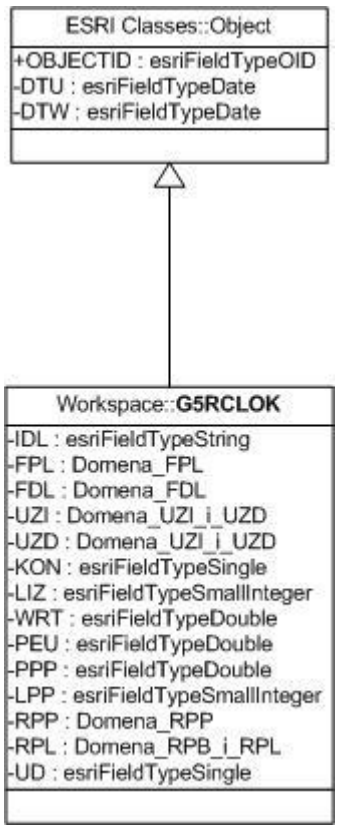

Fig. 5. The modelling of flat (G5RCLOK) object in UML.

The *generalization shape* link was used in the prices' and values' register modelling. Objects linked with generalization shape are correctly projected into geodatabase model build in ArcGIS. The flat (*G5RCLOK*) object modelling is shown at fig. 5. The modelling for objects with spatial reference parcel (*G5RCDZE*) and building (*G5RCBUD*) is presented at fig. 6. It was also necessary to create proper links between registers' objects in order to build proper geodatabase structure. The example of such linking between address (*G5RCADR*) and building (*G5RCBUD*) is shown at fig. 7.

4. THE PRICES' AND VALUES' REGISTER DATABASE EXPORT INTO XMI/XML FORMAT

The standards based on XML have been getting very popular lately. XML (*Extensible Markup Language*) itself is the computer language used for designing data formats. XML is very flexible, so it may be used for writing any data. With XML we may create and oversee data hierarchical structures. XMI (XML Meta-Data Interchange) is standard XML data exchange mechanism. XMI includes definitions of all used elements and enables writing XML file as an XMI file.

The database of prices' and values' register for real estates built in UML schema was checked with *SemanticsChecker* macro prepared by ESRI. When applying this macro for our model we may check semantics of the UML schema. Using uml.dtd file we can verify its compliance with ArcInfo model. The uml.dtd is a document type definition file. Generally dtd type files include information of all elements used in XML file and enable writing XML file as XMI. Using dtd file, computer program interpreting XML type file gets information on its proper structure. The uml.dtd file enables writing prices' and values' register created model in XMI format that additionally meets ArcInfo model assumptions (*ArcInfo UML model*). The correct prices' and values' register UML schema was then exported into XMI format, using *ESRI XMI Export* Add-On.

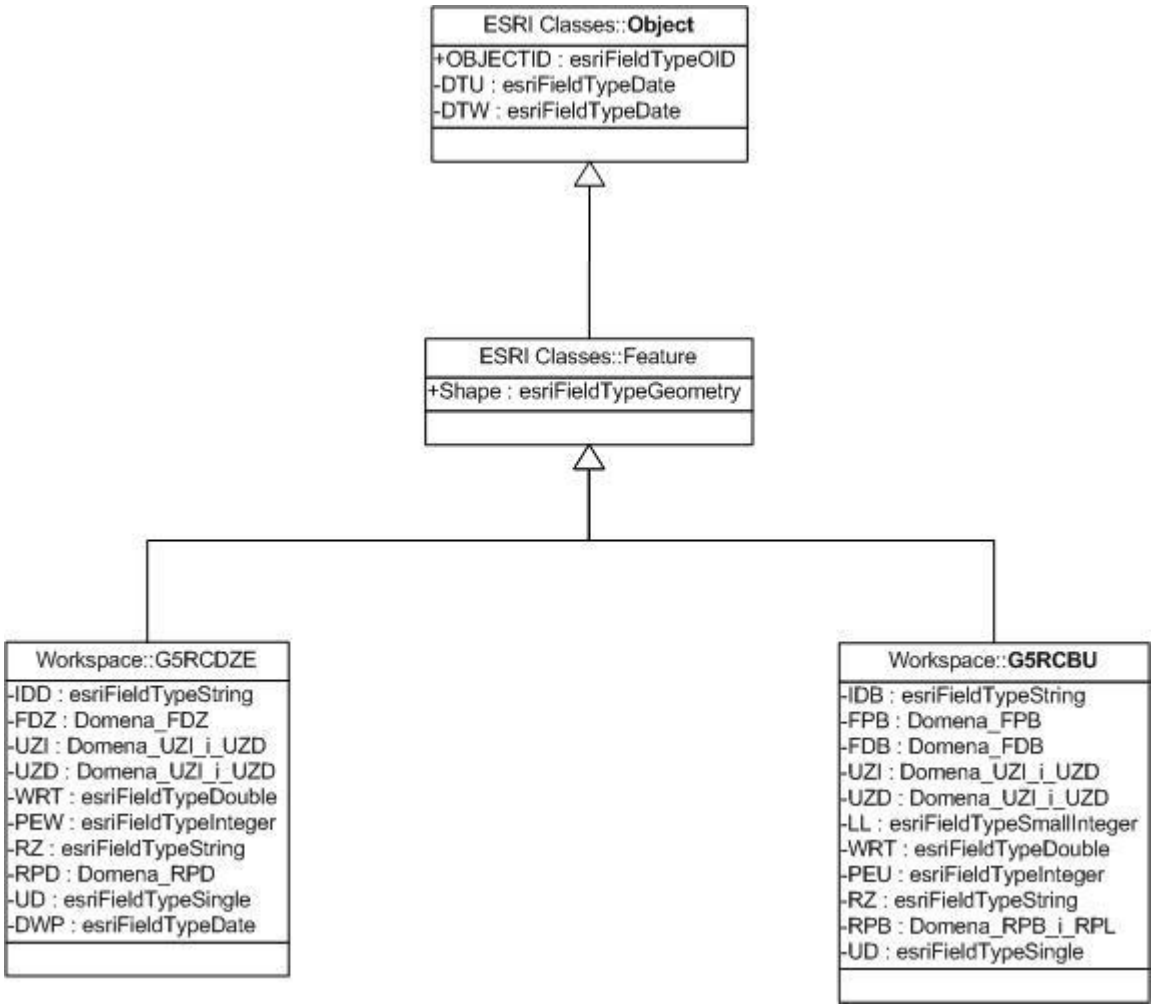

Fig. 6. The objects of spatial reference modelling.

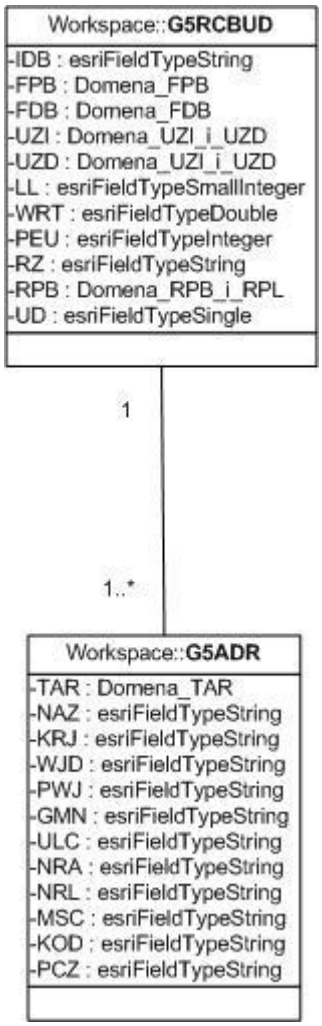

Fig. 7. The link between address (G5RCADR) and building (G5RCBUD).

5. THE DATABASE IMPORT INTO ARCGIS

The correct prices' and values' register UML model was exported into XMI file and it was possible to import it into ArcCatalog, which is part of ArcGIS computer system. Prior to XMI file import an empty database was created with ArcCatalog. Then the XMI file of prices' and values' register UML model was imported, with application *Schema Wizard* tool.

Generally, three types of data sets were imported into database. They are the objects of object and feature class and relationships. As it is mentioned above, object class is represented by address (*G5RCADR*) or document (*G5RCDOK*), feature class objects are parcel (*G5RCDZE*) or building (*G5RCBUD*) and relationships are for example links between address (*G5RCADR*) and parcel (*G5RCDZE*) or building (*G5RCBUD*) and flat (*G5RCLOK*).

It was possible to review and modify objects' attributes and relationships during import into ArcCatalog. When importing feature class objects, it was necessary to choose proper geometry type, so the polygon type was chosen.
The final result of our researches is geodatabase in mdb format, meeting designed in UML prices' and values' register structure. Such a database is ready for data and possible further processing with ArcGIS or other programs managing databases (Microsoft Access, Microsoft SQL Server, Oracle, etc). Additionally, the report concerning import process was generated into text file.

6. PRACTICAL COMMENTS

The method described in the paper was applied for prices' and values' register for real estates database creation. During this geodatabase building we should take some factors into account. The prices' and values' register schema described in [Instruction, 2003] may be easily drawn with Unified Modelling Language, but it is very difficult to prepare this model in a way that it will correspond with ArcInfo software. For building such a corresponding model, it is necessary to define object class, feature class and relationships. To obtain complete prices' and values' register model, all of it objects and relationships should be taken into account. If we don't do it, we will obtain correct but not complete geodatabase for prices' and values' register for real estates.

REFERENCES

Bydłosz, J., Parzych, P., The cadastral data exchange standards in Poland, FIG Working Week 2007, Strategic Integration of Surveying Services, Hong Kong SAR, China.

Dębińska, E., Cichociński P. 2006, Application of CASE tools for Geographic Information Systems databases designing, ZN AGH, Geodezja, t.12, z. 2/1 (published in Polish).

Perencsik, A., Idolyantes E., Booth, B., Anrade, J., 2004, ArcGIS 9. Introduction to CASE Tools. ESRI Press, Redlands.

The Act – in case of Real Estates' Management, 1997, (published in Polish).

The Act – Surveying and Mapping Law, 1989, (published in Polish).

The Order of Ministry of Regional Development and Buildings – in case of Ground Cadastre and Buildings, 2001, (published in Polish).

The Technical Instruction G-5, The Ground Cadastre and Buildings, 2003, Warsaw, The Main Surveying and Cartographic Bureau, (published in Polish).

UML (Unified Modelling Language), 2008, www.uml.org.

CONTACTS

Dr. Jarosław Bydłosz
AGH University of Science and Technology
Al. Mickiewicza 30
30-059 Kraków
POLAND
Tel. +48 12 617 22 67
Fax + 48 12 617 45 88
Email:bydlosz@agh.edu.pl

Dr. Piotr Parzych
AGH University of Science and Technology
Al. Mickiewicza 30
30-059 Kraków
POLAND
Tel. +48 12 617 22 67
Fax + 48 12 617 45 88
Email: parzych@agh.edu.pl