

Jarosław Bydłoz*

The Register of Prices and Values for Real Estates Database Modelling, Applying Computer Aided Software Engineering Tools**

1. Introduction

Nowadays, there is quite a lot of software solutions applied in managing Ground and Building Cadastre. This software works on already existing CAD (AutoCAD, Microstation) or GIS applications (ArcGIS), databases (Oracle, Microsoft SQL Server) and other original solutions.

The author's intention is creating such a database schema that will be at least partly universal and not dependent from existing solutions. The Ground and Building Cadastre database is quite complicated, so the author has tried to build database only for the register of prices and values for real estates, which is the integral part of cadastre. The geodatabase creation schema that has been described earlier was used in this work. This schema has been already applied in Poland [4, 2] and other countries [11]. The purpose of explorations that have been described in this paper was the register of prices and values database creating. Such a database should be ready for filling with data and further application.

2. Contents and Legal Basis of the Register of Prices and Values for Real Estates

Ground and Building Cadastre is important place for Land Information System data collecting. The register of prices and values is its integral component. The Surveying and Mapping Law [10] provides rules on Ground and Building Ca-

* Faculty of Mining Surveying and Environmental Engineering, AGH University of Science and Technology, Krakow

** This work is financed from funds for science realized at AGH University of Science and Technology allocated for the year 2008, no 10.10.150.903

dastre managing. According to the Law it is run as a computer database. It also is one of few Spatial Information Systems having so high computerization level.

The outlines concerning cadastre, including the register of prices and values for real estates (RCiWN) are defined by The Order of Ministry of Regional Development and Buildings [7]. The detailed outlines for establishing and managing cadastre are given in the instruction G-5 [5].

According to the order of ministry of regional development and buildings, county chief is in charge of register of prices and values 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 register of prices and values:

- real estate's price and value,
- 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 county chief enables access to register of prices and values according to the Surveying and Mapping Law.

The technical norms of establishing and managing of register of prices and values for real estates are comprised in the technical instruction G-5. According to the 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 [9]. The master maps, technical infrastructure cadastre, local spatial plans are additional data sources for the register of prices and values. 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.

3. The Stages in the Register of Prices and Values Modelling

The register of prices and values for real estates modelling presented in this paper consists of three following stages:

- conceptual modelling,
- logical model building,
- physical model creation.

The modelling schema that was presented in [6] was applied here. This schema is shown at figure 1.

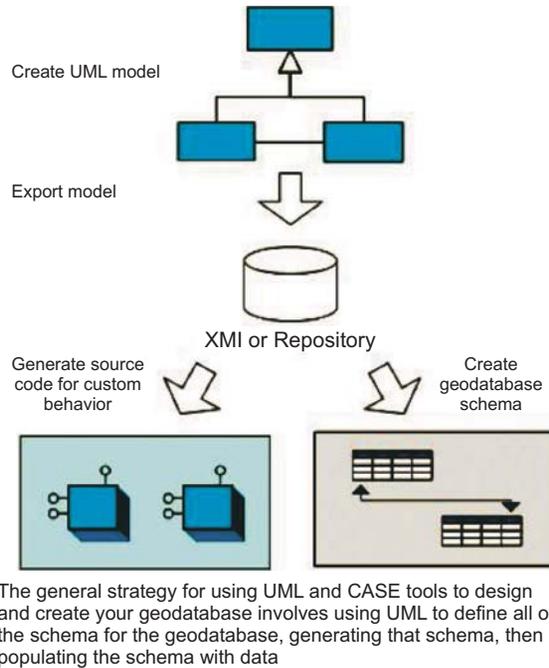


Fig. 1. The schema of geodatabase creating applying CASE tools according to [6]

4. Conceptual Modelling

The conceptual modelling bases are comprised in the instruction G-5 [5]. The modelling process itself is practically already done, for the instruction G-5 includes the register of prices and values database objects catalogue and relation schema between them. The relations between register's objects are presented at figure 2. The register of prices and values database objects catalogue includes register's objects and its attributes (including attributes allowed values).

The register of prices and values for real estates consists of following objects:

- transaction or valuation concerning estate (G5RCW),
- estate or its part (G5RCNIER),
- parcel description (G5RCDZE),
- building description (G5RCBUD),
- flat description (G5RCLOK),
- receivables (G5RCOBC).

Two additional cadastral database objects are used for the register of prices and values database creation, as well [7]. They are:

- document (G5DOK),
- address (G5ADR).

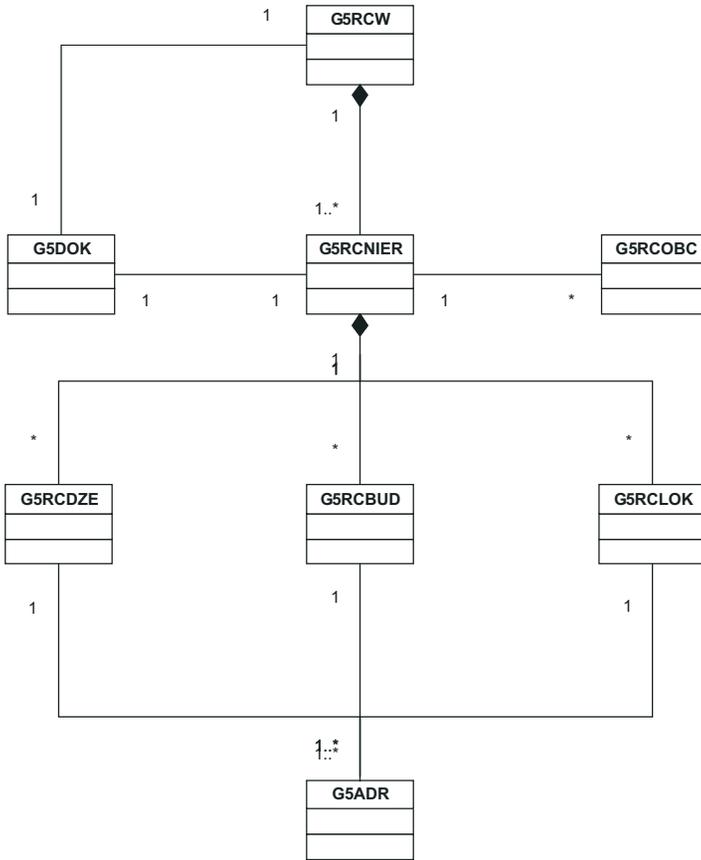


Fig. 2. The register of prices and values objects according to the instruction G-5

The register of prices and values objects in this schema are connected with two types of links – association and aggregation. Association is illustrated by the line's segment and aggregation by the line's segment with diamond at one end. Association simply connects the objects of two classes and aggregation shows that an object belonging to one class is the part of other class. The diamond is situated on the whole (not on the part) side.

5. The Problems of Logical Modelling

Having modelling procedure and conceptual register's model already completed, the register of prices and values logical modelling was started. It was being presumed that final database would be exported into XML file. Then the register of prices and values geodatabase would be created, applying ArcGIS system.

Workspace: G5RCNIER
-RDN : Domena_RDN
-OPIS : esriFieldTypeString
-UZG : Domena_UZG
-WRT : esriFieldTypeDouble

Fig. 3. Object G5RCNIER (estate or its part) and its attributes

«CodedValueDomain» Domena_FOB
+FieldType : esriFieldType = esriFieldTypeInteger
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+Wolny rynek : esriFieldTypeInteger = 1
+sprzedaz : esriFieldTypeInteger = 2
+sprzedaz przetargowa : esriFieldTypeInteger = 3

Fig. 4. FOB (transaction type) domain

The Microsoft Visio 2003 software was used for the register of prices and values modelling. *The Arc Info UML Model* template that was downloaded from ESRI website was applied as well. The first stage of logical modelling was UML schema building, according to the instruction G-5. Then attributes were added to register of prices and values objects. The domains (*CodedValueDomain*) were created according to the ESRI template for attributes having predefined values. For other attributes, their field types were defined correspondingly to ESRI notation. The G5RCNIER object (estate or its part) was presented at figure 3. The FOB domain (transaction type) was shown at figure 4. If we want created model to correspond with ArcInfo UML model, it should be linked with predefined UML objects delivered by ESRI. All register's objects are of nonspatial type, so they were linked with ArcGIS *object class* objects. The link called generalization was used. The object class is a table in geodatabase collecting nonspatial data in ArcGIS software, thus feature class is the collection of objects having the same geometry and attributes. The generalization shape that is illustrated by arrow having empty triangular pike is used in linking register of prices and values objects with ArcGIS object class objects. Generalization is relation between specific element and general element that specific element fully complies with general element. The specific element also can contain additional information like attributes or links. In proposed solution all prices' and values' register objects get three attributes OBJECTID (ESRI object identification), DTU (object's creation date) and DTW (object's verification date). The generalization link for G5RCW object (transaction or valuation) is presented at figure 5.

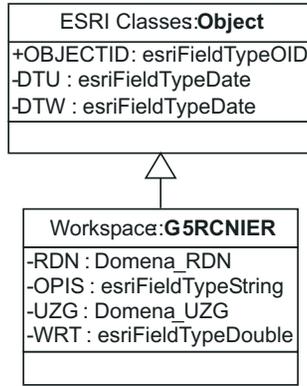


Fig. 5. The generalization link for G5RCW (transaction or valuation)

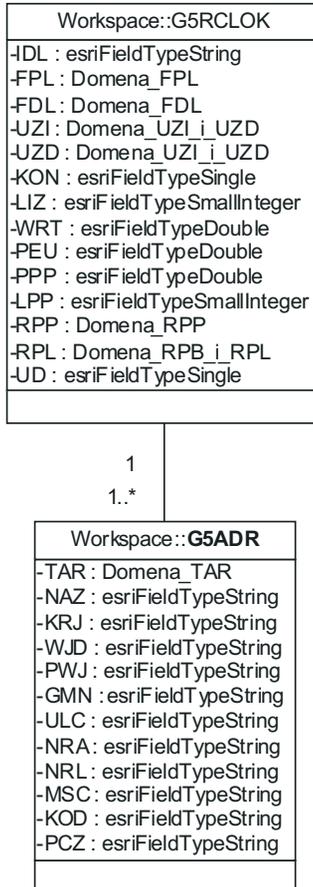


Fig. 6. The association linking G5RCLOK (flat description) and G5ADR (address)

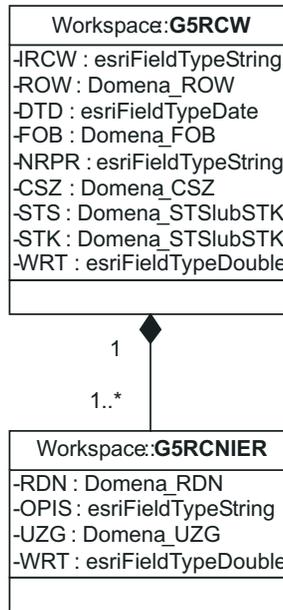


Fig. 7. Linking G5RCW (transaction or valuation) and G5RCNIER (estate or its part) using composition

After completing linking the register of prices and values objects with ArcGIS objects all register’s objects are of ArcGIS object class type, but there is no relationships among them. So the relationships modelling were started. In the beginning, links between G5RCDZE, G5RCBUD, G5RCLOK and G5ADR (parcel, building and flat with address objects) were modeled. Then G5RCW, G5RCNIER with G5DOK (transaction or valuation and estate or its part with document objects) and G5RCNIER with G5RCOBC (receivables) objects were linked. The simple link called association was applied here. The link between G5RCLOK and G5ADR is show at figure 6.

The following stage of logical modeling was making link between G5RCW and G5RCNIER (Fig. 7). There is no aggregation link in Microsoft Visio software, so the composition (illustrated by opaque diamond) was used. The composition is the “stronger” case of aggregation, where periods of the specific element and general element have an identical time of existence [3]. This relation implies that every transaction or valuation concerns one or more estates or its parts. Then aggregations between G5RCNIER, G5RCDZE, G5RCBUD and G5RCLOK were modeled. These relations imply that an estate can include any number of parcels, buildings or estates.

6. Physical Modelling

The register of prices and values schema that has been modelled was then exported into XMI format with *ESRI XMI Export* add-on. XMI (XML Meta-Data Interchange) is a standard exchange mechanism that uses XML.

Then the resulting file was checked with *SemanticsChecker* macro delivered by ESRI. *SemanticsChecker* macro is used not only for semantics control but it checks ArcInfo correspondence as well, applying *uml.dtd* file. The *uml.dtd* is a Document Type Definition file. Generally DTD type file includes definitions of all objects that may be used.

When using DTD type file the program that interprets XML gets information on structure's syntax (names, sequence, rooting and so like). The *uml.dtd* file enables UML model writing in XML (XMI) format that fills ArcInfo (*ArcInfo UML model*) conditions.

The XML file with the register of prices and values schema, checked for semantic correctness and ArcInfo correspondence was then imported into ArcCatalog, which is the ArcGIS part. The *Schema Wizard* tool was used during file import. Completing XML file import resulted in obtaining the register of prices and values geodatabase in mdb format. All of eight registers objects, six simple links illustrating association and four links illustrating composition were correctly modelled into MDB file.

7. Recapitulation

The final results of this work are files in mdb and XML formats containing the register of prices and values schema. Mdb file is ready for feeding with data.

I think that the database in mdb format should be filled with data and some practical tests should be performed, for the further application of obtained results. The register of prices and values objects do not have spatial reference, so possibilities of working with them applying ArcGIS are restricted. When modelling graphical objects like G5DZE (parcel) or G5BUD (building) they would be wider. In the starting works concerning the register of prices and values modelling [1] it was presumed that objects like G5RCDZE or G5RCBUD could have spatial reference, however according to the register's detailed contents it is not possible.

The obtained XML file containing the register of prices and values schema has quite complicated structure. In my opinion some works on its simplification could help in its possible application in ground and building cadastre.

References

- [1] Bydłosz J., Parzych P.: *The cadastral geodatabase modelling in Poland, applying Computer Aided Software Engineering tools*. FIG Working Week 2008 "Integrating the Generations", Stockholm 2008.
- [2] Chojka A., Iżykowska A., Zwirowicz A.: *Próba budowy aplikacji narzędziowej GIS na podstawie modelu pojęciowego*. Roczniki Geomatyki, t. V, z. 1, 2007.
- [3] Connolly T., Begg C.: *Systemy baz danych. Praktyczne metody projektowania, implementacji i zarządzania, tom 1*. Wydawnictwo RM, Warszawa 2004.
- [4] Dębińska E.: *Modelowanie pojęciowe w języku UML dla potrzeb wyceny nieruchomości*. Roczniki Geomatyki, t. IV, z. 2, 2006.
- [5] Instrukcja techniczna G-5: *Ewidencja gruntów i budynków*. GUGiK, Warszawa 2003.
- [6] Perencsik A., Idolyantes E., Booth B., Anrade J.: *ArcGIS 9. Introduction to CASE Tools*. ESRI Press, Redlands 2004.
- [7] *Rozporządzenie Ministra Rozwoju Regionalnego i Budownictwa z dnia 29 marca 2001 r. w sprawie ewidencji gruntów i budynków*. Dz.U. Nr 38 z 2001 r. poz. 454.
- [8] Stevens P.: *UML. Inżynieria oprogramowania. Wyd. II*. Helion, Gliwice 2007.
- [9] *Ustawa o gospodarce nieruchomościami z dnia 21 sierpnia 1997 r.* Dz. U. Nr 115 z 1997 r. poz. 741, z późn. zm.
- [10] *Ustawa z dnia 17 maja 1989 r. Prawo geodezyjne i kartograficzne*. Dz. U. Nr 30, poz. 163, z późn. zm.
- [11] Verlinden W., Bayers E.: *Geomodeling and Implementation of a Geodatabase Using CASE-tools and ArcCatalog*. ESRI Professional Papers, 2005.