

Towards a profile of the land administration domain model (LADM) for South Africa

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Abstract

The Land Administration Domain Model (LADM) is a spatial domain model for land administration, developed as an International Standard by the ISO/TC211 *Geographic information/Geomatics*. The standard provides a conceptual schema focusing on rights, responsibilities and restrictions affecting land (or water), and their geospatial information components. The aim of the standard is to improve communication by introducing standard concepts or vocabulary in the land administration domain. This is aimed at improving interoperability between cadastral or related information systems, thus improving exchange of land information between local, national and international organisations (both private and public) and information society at large. The LADM is not intended to be complete for any particular country, but rather aims to be the basis from which a country-specific model can be developed. Various research efforts have been undertaken to develop LADM for different countries and jurisdictions. For example, the Social Tenure Domain Model (STDM) supports areas falling outside formal tenure and cadastral systems, such as informal settlements and rural areas governed by customary laws and traditional practices. In Japan, Portugal, Indonesia, Tanzania, Trinidad and Tobago and other European countries studies were carried out to investigate the use of LADM in their respective land administration systems. This paper reports on a research project about the development of an LADM profile for South African land administration.

Keywords: Land administration, LADM, deeds registries, land registration, land information, South Africa.

1. INTRODUCTION

Land administration is a fairly new discipline but the cadastre, land registration, surveying and mapping, which are the key components of land administration, have been part of human civilization for decades (Enemark et al., 2010). Modern surveying and cadastres have a long history of more than 100 years (Williamson, 2001, Enemark et al., 2010). The earliest records of land ownership date back to the Royal Registry of ancient Egypt which was created in about 3000 BCE (Enemark et al., 2010). The history of cadastral and land registration in South Africa commenced in 1652 when the first European settlement was established on the southern tip of Africa, the Cape. According to historical notes (Baker, 1958), the first land surveyor came to the Cape in 1957. The 19th century can be regarded as the beginning of the cadastral survey in South Africa with the first cadastral survey done on a piece of land on the banks of the Liesbeeck River.

There are many definitions of land administration, however one of the universally accepted definitions in land administration literature is offered by the United Nations (UN-ECE, 1996) as 'the processes of recording and disseminating information about ownership, value, use and its associated resources when implementing land management policies'. In ISO 19152, *Geographic information – Land administration domain model (LADM)*, land administration is defined as the 'process of determining, recording and disseminating information about the relationship between people and

land' (ISO/DIS 19152:2011). Land administration can therefore be broadly described as dealing with information about the relationship between humankind and land, with ownership as one of the most important aspects in this relationship. The manner in which ownership over land is held is referred to as land tenure. Land tenure reflects the social relationship between land and people.

This relationship is legible for registration in title registration or deeds registration systems in some countries. In South Africa, the humankind-land relationship based on custom (unwritten) and traditions of indigenous people and remains illegible for formal registration systems. South Africa is facing the challenge of having to integrate indigenous cultures and informal tenure systems into formal registration, thus leading to rapid growth of informal sectors and institutions related to land. Land administration is not only about information related to land (i.e. geospatial information) but it also deals with the relationship between people over land. This affects the manner in which land is accessed, used, developed and managed.

Land administration is a large field and deals with high volumes of spatial information which is dynamic in nature, thus requiring constant updating to remain meaningful and relevant to a society where Information technology, globalisation and sustainable development are current key drivers of change. Worldwide, countries have been undertaking various land administration projects and innovations to improve their effectiveness and efficiencies of land administration systems. In the areas of spatial information component, a domain specific model for land administration is one of the major international commitments to improve accessibility, sharing and integration of land information in support of local, national and global spatial data infrastructures (SDIs) objectives. These objectives include the need for data exchange or sharing amongst organisations and the public.

In the land administration domain, one of the key challenges is that cadastral systems differ between countries and generate varied data models, which are often not compatible with one another. Some countries use cadastral systems that are based on land title registration while others use deeds registration. In some countries these systems are centralised, in others not. Furthermore, in some countries the principle of general boundaries is applied while in others fixed boundaries are used. In certain countries cadastral systems are designed for fiscal purposes and others for legal purposes or a combination of both. These variations often lead to different concepts and incompatible data models. Worldwide, initiatives that attempt to improve the cadastral system issues are growing. The Land Administration Domain Model (LADM) is the most outstanding effort in the area of spatial and cadastral domain modelling (van Oosterom et al., 2006). The goal behind the model is to improve communication between and amongst these cadastral systems.

The LADM is an international standard data model being developed by the International Standardization Organisation (ISO) under Technical Committee 211 for Geographic information/Geomatics. The LADM is a specific domain model dealing with that part of land administration which deals with rights, restrictions and responsibilities (RRRs) and their geospatial (geometric) information component (van Oosterom et al., 2006;). The aim of this spatial domain model is to improve communication through introducing standard concepts or vocabulary in the land administration domain. This is aimed at improving interoperability between cadastral or related information systems, thus improving exchange of land information between local, national and international organisations (both private and public) and information society at large.

Many research efforts with the aim of supporting the implementation of the LADM have been undertaking following various versions of the model in different countries and jurisdictions. For example, the Social Tenure Domain Model (STDM) has been developed by UN-HABITAT as a subset of LADM to support areas falling outside the formal tenure system and cadastral system, such as informal settlements and rural areas governed by customary laws and traditional practices. Japan, Portugal, Indonesia, Tanzania, Trinidad and Tobago and other European countries are examples of countries where LADM studies were carried out (Augustinus et al., 2006; Ary Sucaya, 2009; Hespanh et al., 2006; Devos et al., 2010; Griffith-Charles, 2010).

In South Africa, an investigation dealing with the application of the LADM relevant to its unique situation is solely lacking. This is a worry factor given the benefits that the LADM is attributed to deliver. The purpose of this paper is to report about a research project with the aim of developing a country-specific profile of LADM for South Africa. The remainder of the paper is structured as follows: in section 2 we describe land administration in South Africa; in section 3 we provide a brief overview of the LADM and present the three main packages of the LADM, i.e. Party, Administrative and Spatial Unit; in section 4 we present the SA profile of these three packages; section 5 concludes and describes the way forward.

2. LAND ADMINISTRATION IN SOUTH AFRICA

South Africa (also referred to as Republic of South Africa, RSA or SA) is a country located on the southern tip of Africa. The total coastline stretches for 2,789 kilometers. South Africa is bordered by Namibia; Botswana and Zimbabwe in the north and to the east are Mozambique and Swaziland while Lesotho is an enclave surrounded by the South African boundaries. The country has 1,2 million square kilometers of land hosting a population of approximately 50 million people (Statistics South Africa, 2011). According to the AfriGIS data catalogue (2011), there are about 7.5 million land parcels (urban and rural) in their cadastral dataset, one of the most comprehensive national cadastral datasets in the country. This amounts to 150,000 land parcels per million people. A few years ago Rajabifard et al., (2007) provided the following cadastral statistics for South Africa: 70% of land parcels in urban areas and 80% in rural areas are legally registered and surveyed; 5% of parcels in urban areas and 15% in rural areas are legally occupied but not registered or surveyed; 20% of parcels in urban and 5% in rural areas are informally occupied without legal title.

The land administration system in South Africa operates under Roman-Dutch law and customary law is also recognised. Certain land tenure rights are formally recognised and registered under a deeds registry system. However, the law does not guarantee title to land and other real rights. These rights include, for example, full ownership (freehold), title in land and sectional title units, long term leases (over ten years), leasehold rights, servitudes, mineral cessions, mineral leases, prospecting contracts. Types of rights which are informally recognized (including customary systems) include: customary tenure; informal settlements right; the rights of squatters; occupancy rights; adverse possession; anti-eviction rights.

In urban areas, inferior titles to land owned by the Blacks prior to 1994 have been upgraded to freehold rights through administrative processes. In rural land of the former homeland, securing land tenure still remains a major challenge. The Communal Land Rights Act (CLARA) of 2004 which was aimed at securing land rights in rural areas was ruled out in 2011 as unconstitutional (Cousins and Hall, 2011). It was successfully argued that the CLRA was undemocratic as it did not provide the rural communities a freedom to choose pertinent to the nature of the tenure system to be implemented or choose of local institutions which should be given land

administration responsibility. Moreover, the Act made no provision for accountability of land administrators to rights holders, and it not adequately address inequalities inherent in the old order rights (such as PTOs), which would be upgraded to new order rights' in terms of this CLRA. Different types of informal tenure exist in South Africa. For example, customary tenure is not necessarily a land right but the rights of occupation are protected. Similarly, informal settlement tenure is not a land right but the occupants can obtain adverse possession after five years and can be evicted only in terms of specific procedures. South Africa has numerous large informal settlements in urban areas without formal land rights but protected to some extent under anti-eviction laws (Hall 2009).

The South African land policy is part of the national policy on promoting objectives such as poverty reduction, sustainable agriculture, sustainable human settlement, economic development, social justice and equity and political stability. The major challenges facing land policy makers in the contemporary South Africa are to deal effectively with the legacies of past colonial and apartheid eras. These include addressing the injustice of racially-motivated land dispossession; the need for a more equitable distribution land ownership among various groups within society; the need for land reform to reduce poverty and contribute to economic growth; security of tenure for all, and the need for a land management system that supports sustainable land use patterns and the rapid release of land for development. To address the consequences of apartheid legacy, South Africa's Constitution included the following three clauses:

“A person or community dispossessed of property after 19 June 1913 as a result of the past racial discriminatory laws or practice is entitled, to the extent provided by an Act of Parliament, either, to restitution of the property, or to equitable redress;

The state must take reasonable legislative and other measures, within its available resources, to foster conditions which enable citizen to gain access to land on an equitable basis;

A person or community whose tenure of land is legally insecure as a result of past racially discriminatory laws or practice is entitled, to the extent provided by an Act of Parliament, either to tenure which is legally secure, or to comparable redress.” (South Africa, 1997)

Land policy implementation in South Africa, as in many other countries, relies on how access to land and land-related opportunities are undertaken. Land-related activities of government include regulating the land tenure (rights in land), controlling the land use and land development.

2.2.1 Land tenure

Ownership is essentially a legal process that depends on “title”, which is the evidence that proves who has the rights to property. The manner in which rights over land are held is referred as the system of land tenure (United Nations, 1996). Land tenure right is described as any leasehold, deed of grant, quitrent or any other right to the occupation of land created by or under any law and, in relation to tribal land, includes any rights to the occupation of such land under the indigenous law or customs of the tribe in question (The Upgrading of the Tenure Rights Act No. 1927 of 1991). This reflects the dual system of land rights: one is based on the western system of landholding originating from colonial systems of Dutch and British landholding and the other is based on customary law.

South Africa has a long-established tradition in cadastral system (Simpson, 1976; Leisz, 1996). The definition of a parcel varies according to the jurisdiction. For

practical purposes, a parcel is a closed polygon on the surface of the Earth (United Nation, 2004). Land parcel is regarded as a building block of any land administration system (Enemark, 2010). However, land parcels lack sufficient flexibility to incorporate the increasing number and diversity of interests in land (Kalantari et al., 2008). Property has different meanings in various countries and is often used in conjunction with land parcels (Steudler et al., 2004 cited by Kalantari et al. 2008). A property is often defined as the building(s) associated with land.

2.2.2 Land value

In South Africa land value information is usually captured through the land registration processes when land is transferred from one party to another in the deed registry office. This data is captured and sent to a valuation system. Valuation subsystems are not truly spatially enabled. For example, in the deeds registry, valuation or taxation data comes in as attributes associated with property identifiers. The ability to secure revenue from assessments rates is dependent on accurate and timely identification of properties, the timely valuation of the property and accurate and prompt transfer of that information to billing processes. In South Africa municipalities are lawfully mandated by law to in terms of In the Local Government Municipal Property Rates Act (No. 6 of 2004) to impose rates on property and implement “transparent and fair system” of valuation of properties.

2.2.3 Land use and development

Land use has a variety of meanings from the nature of the vegetation that grows upon land to the human activities that relate to the land (United Nations, 2004). The classification of land use based on nature of vegetation categories such as: cropland, woodlands, swamps and marshes, horticulture etc. The classification of land use based on human activities include: residential, industrial, commercial, recreational etc. Each category can be subdivided into subcategories. Each broad category represents a zone in which a certain activity may be permitted. For example, heavy industry (with its’ potential to generate noise and air pollution) is collected in one zone and separate from residence or housing area (with its’ need for peace, quietness and clean air).

In South Africa, local government has a function of land use and planning. At national level, there is limited planning for land use. Agriculture is identified as an important sector of the economy. The Land Use Management Bill of 2006 (still in draft since 2008) is aimed at allocating authority with certain limits to municipalities in as far as land use decisions are concerned (Hall, 2009). The Bill provides municipalities with responsibility to develop ‘land use schemes’ to regulate how land is used and managed within their respective jurisdictions. In 2007, the Department of Rural Development and Land Reform adopted the Area Based Approach (ABP) as a new mechanism to planning land reform. In terms of the ABP approach, plans specifying which land should be acquired for redistribution and what kinds of farming and other activities are to be supported. These plans will be aligned with spatial development plans at municipal levels and are to form part of integrated development plans (IDPs) (Hall, 2009).

In terms of land use information, land parcels are used to spatially define and identify land use, however they are not flexible to incorporate other forms of interests in land (Kalantari et al (2008). Therefore, there is a need for a flexible data model that is able to accommodate various interests in land such as rights, restrictions and responsibilities affecting land. Land use or zoning scheme is a form restriction. The

LADM is flexible model that incorporates rights, restrictions, and responsibilities (RRRs) affecting land (or water). This model is discussed in the following section.

3. LAND ADMINISTRATION DOMAIN MODEL (LADM) AND ITS APPLICATION TO SOUTH AFRICA

The following section briefly provides an overview of LADM and its history of development. The current draft version of the model is a product of extensive discussions amongst international experts in various forums, workshops and several case studies in countries such as Netherlands, Denmark, Portugal, Australia, Nepal and several African and Arab countries (van Oosterom et al., 2006; Devos et al., 2010). The key considerations in the design of the model were that it should be flexible enough to accommodate all common aspects of cadastral registrations internationally, it should be based on the Cadastre 2014, should be consistent with ISO and OGC standards and it should be as simple as possible for easy practical application (van Oosterom et al., 2006). The ultimate goal of the LADM is improve interoperability (communication) between land administration systems locally, nationally and internationally. Parties involved in land transactions are to benefit from improved communication which is facilitated by shared vocabulary or concepts applied in these model.

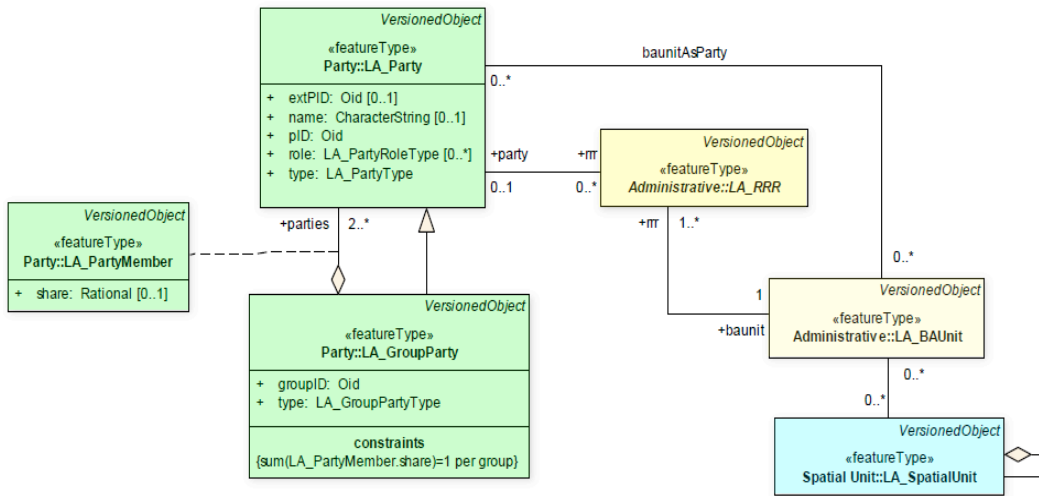
The LADM is organised into three packages and one subpackage. These are groups of classes with a certain level of cohesion. The packages are: Party Package; Administrative Package; Spatial Unit Package and subpackage: Surveying and Spatial Representation Subpackage. Figure 1 shows the overview of these (sub) packages with their classes. The complete model may be implemented through a distributed set of (geo-) information systems, each supporting data maintenance activities and the provision of elements of the model. The model may also be implemented by one or more maintenance organisations, operating at national, regional or local level. Different organisations have their own responsibilities in data maintenance and supply, but may communicate on the basis of standardised administrative and technical update processes.

. The Deeds Registries Act 47 of 1937 and the Sectional Titles Act 95 of 1986 and the regulations promulgated in terms thereof were reviewed. These two Acts forms the foundation of the South African land registration system. Various other Acts, Ordinances and Rules of the Courts were reviewed: township planning ordinances; rules 63 of the High Court Rules, Chief Registrar's Circulars (CRCs), common law (Roman-Dutch law), Registrar's Conference Resolutions (RCRs), South African Deeds Journals (SADJ) and other associated documents. These documents also contain specific provisions in respect of registration procedures and information content which must be complied with in respect of land registration. The review of all these sources of the South African registration system offered understanding of South African land administration system (registration of land tenure and cadastre). The sample data to be used in the generation of the in the profile for South Africa has been collected from the Deeds Registrar's office (land tenure/ownership) and Surveyor-General's office (cadastral data) and the City of Johannesburg (valuation and land use).

3.1 Party package

The main class of the party package is LA_Party (with 'party' as an instance), and its' specialization LA_GroupParty (with 'group party' as an instance). There is an optional association class LA_PartyMember (Figure 1).

Figure 1 Party package and associations to other basic classes (ISO/DIS 19152)



In the South African land registration system, the LA_Party, LA_GroupParty and well as LA_PartyMember can be identified. The party types are identified in the deeds registration systems as including the following: natural persons (with name, identify number, marital status as key attributes); companies (with company registered name and company registration number as described in the Companies Act); trust (with its trust name); partnership (with full names and marital status of all partners to such partnership). In South Africa, persons married in community of property (i.e both spouses share each other’s property) both need to be registered in the deeds or documents tendered for registration or execution in the deeds office.

The vesting clause of a deed in respect to a partnership may reads as follows: ‘X, identity number, unmarried, and Y, identity number.....,married out community of property; and Z, identity number.....married in community of property to T....CARRYING ON BUSINESS AS THE XYZ PARTNERSHIP”.

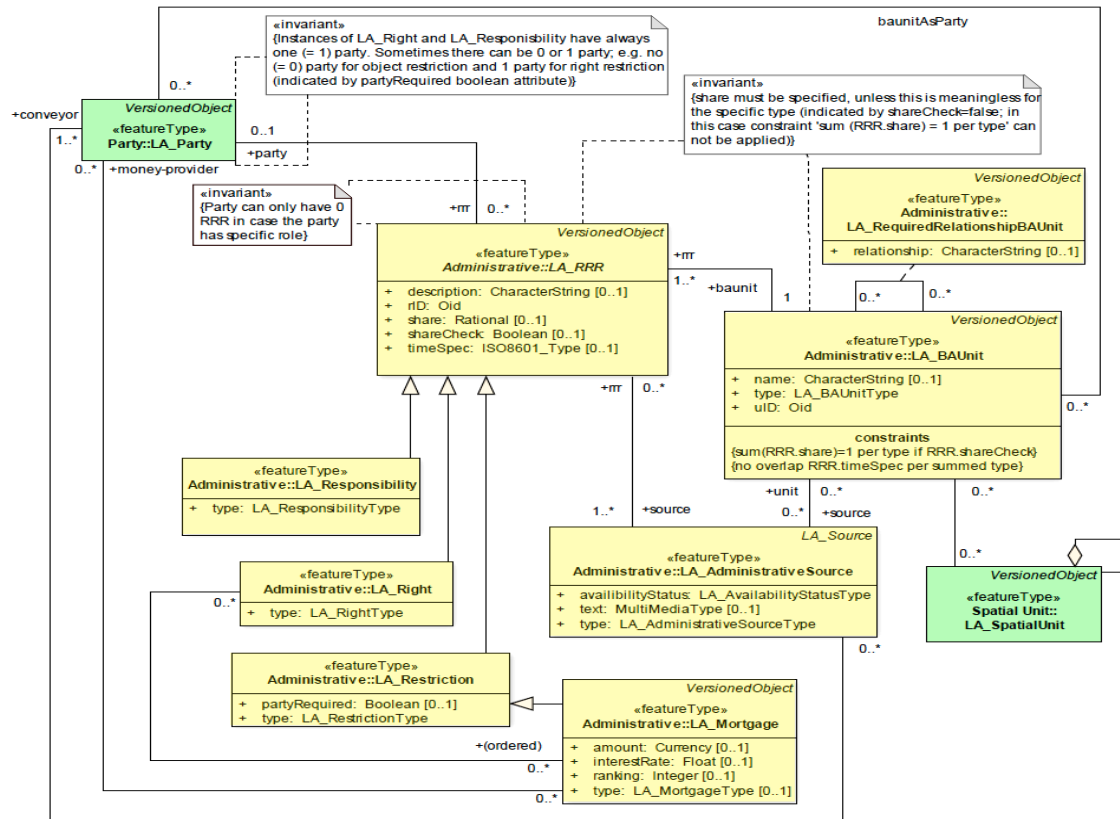
In respect to person married in community of property, the property forms an asset of the joint estate. “X.....identity number and Y....identity number.....married in community of property to one another”.

The two examples, presented above, can be described in the LA_GroupParty and LA_GroupMember classes. This is given the fact that parties involved are registered as identifiable entity as it is a case with partnership. All members of the partnerships are identified and registered in the deeds or documents tendered for registration. The shares of the parties are also described. In summary, the Party package with classes is possibly applicable to for South African registration system. Party attributes such as party type and role of party, share, pID, name are applicable to South Africa. However, in South Africa more attributes may need to be included such as the status (i.e. marital) and others.

3.2 Administrative package

The administrative package deals with an abstract class, LA_RRR (with its’ three subclasses LA_Rights, LA_Restriction, and LA_Responsibility), class LA_BAUnit (with ‘basic administrative units’ as instances) LA_RequiredRelationshipBAUnit, LA_Mortgage and LA_Administative Source as indicated in figure 2.

Figure 2 Administrative package and associations to other basic classes (ISO/DIS 19152)



The LADM supports the vision statement 1 of Cadastre 2014 which calls for a complete inclusion of public and private rights and restrictions in the future cadastre (Kaufmann and Steudlers, 1998). In the LADM, rights are classified into two main categories: the formal rights (which include ownership, apartment rights, usufruct, freehold, or leasehold) and the informal rights (customary or indigenous rights). Restrictions associated with rights are also included. Restrictions are defined as “entitlements to refrain from doing something”, such as building within a certain area around a wetland while responsibilities are defined as obligations with an example such as rehabilitating a mining dump after the operation has been decommissioned (ISO/DIS 19152:2011)

In South Africa, each municipality is allowed to develop town planning schemes to control land use rights. These schemes restrict certain activities or use over land or property. In the Deeds registries offices. In respect to responsibility, the owner is responsible for rates and taxes and service fees (such as water, electricity or refuse removal). This function is administered by the local authorities (i.e., municipalities). In order for property to be transferred from one owner to another, the deeds registries office requires the clearance certificates for municipality within which the land is situated in order to approve the deeds of transfer. Mortgage class is regarded as restricted real rights.

In South Africa, the restrictions related to land are also registered in the deeds registry. Restrictive title deed conditions include pre-emptive (a right affording the grantee a preference to buy a particular property should the grantor (owner) wish to sell it); reversionary rights (condition provides that on the occurrence or non-occurrence of some or other even, the ownership of property will revert to the

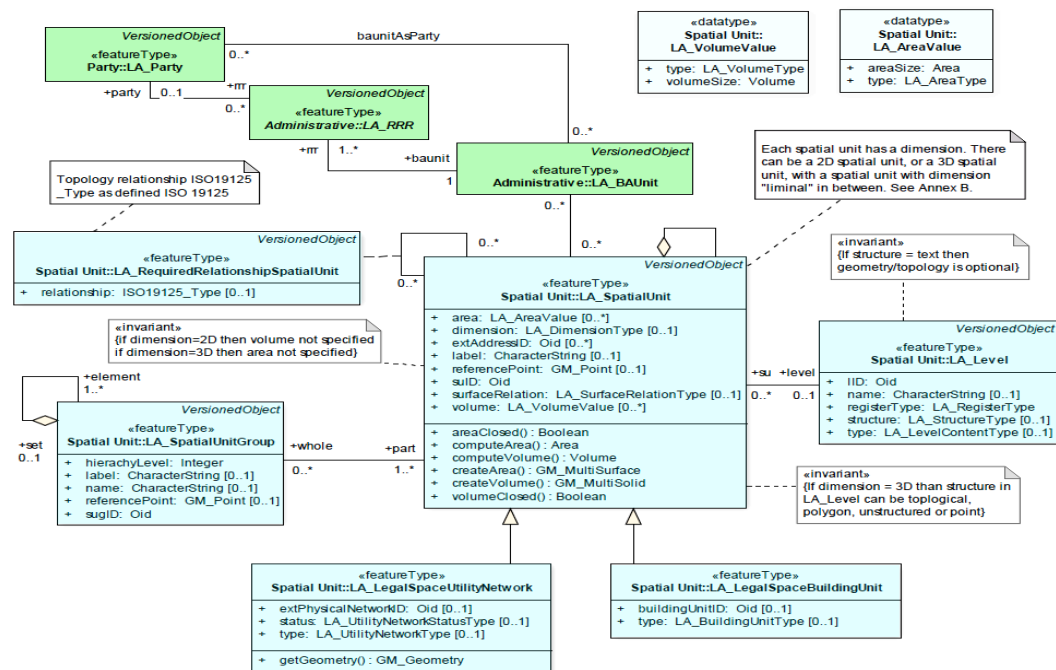
previous owner), personal servitudes of usufruct and many others. The restrictive title deed conditions require legal process to be removed. The removal restrictions have implications on township planning, and are therefore handled by the relevant municipality. The removal of restriction process normally happens concurrently to rezoning process. Once the restrictions are removed, the land will be governed by the relevant town planning scheme or zoning scheme. In summary, the LA_Rights, LA_Restrictions and LA Responsibilities classes are applicable to South African land registration system. The attributes of the three classes are also applicable. However, further investigation is underway to identify other possible attributes.

In the South African title deed (Deed of Transfer) is an official and authentic record of property. This document is filed in a deeds office. It establishes who the registered owner of the property with description and extent of the property. Title deeds may contain conditions which restrict the land uses. For example, the height of a building on a subdivided portion of land may be restricted. The title deeds may contain that gives the owner the responsibility to retain the property in condition or rehabilitate the land (as in mining). In terms of the law, no registration of land can take place without diagrams prepared and approved by the Surveyor General Office. These diagrams are annexed to the deeds or documents.

3.3 Spatial Unit package

LA_SpatialUnit, illustrated in figure 3, refers to spatial units which can be described as an area of land or water where rights and/or social tenure relationships apply. Spatial units can be represented as sketch-based units (i.e sketch maps, photographs); text-based units (descriptive text); point-based units (the coordinates of a single point); line-based ('unstructured' or 'spaghetti') units (hanging lines and incomplete boundaries); polygon-based units which are used when each spatial unit is recorded as a separate entity, and topology-based units which are used when spatial units share boundary representations.

Figure 3 Administrative package and associations to other basic classes (ISO/DIS 19152)



Spatial Unit class in the South African cadastral system can be related to cadastral map. This map is compiled by registered surveyors. The cadastral map shows the relative portion or portions and boundaries of surveyed land parcel or parcels. The main types of cadastral maps are: diagrams (a geometrical figure containing numerical and verbal representations of a piece of land, line, feature or area forming the basis for registration of land tenure (real right). This legal document must contain the signature of a professional land surveyor and being approved by a Surveyor General. The subdivision and consolidation diagrams are the most common these diagrams and depict the following information which forms the basic property information; the unique designation of the property; the illustration showing the property; the boundary description; co-ordinates and numerical data of the beacons and boundaries, and the area if the property. General plan is a plan representing the relative positions and dimensions of two or more pieces of land together with the same essential information in respect of each land parcel. LA_SpatialUnit in the South African land registration is applicable.

This type of plan may comprise of one or many sheets and depict a large number of land parcels (erven or lots). General plans must be signed by a professional land surveyor prepared them and then approved or certified as general plan by the Surveyor-General.

Sectional Title plan is a plan showing portions of buildings (sections) that can be separately owned together with the positioning of these buildings in relation to the land. The floor area of each section is tabulated and the proportion of the total area included in each section, listed. This information is used basically to determine the proportional levy each owner has to pay. In the LA_LegalSpaceBuildingUnit class can be applied in respect of sectional title units as these units are surveyed and registered. In a local municipality, other building plans are approved by municipality.

LA_SpatialUnitGroup can be related to land use schemes (zoning) prepared by municipality. These schemes form together administrative zones. Land use that is compatible with one another are grouped together in one area and kept away from those that are not compatible with one. Therefore, the LA_SpatialUnitGroup is applicable to South African situation. LA_LegalSpaceUtilityNetwork class in a case of South Africa, include, for example, the servitudes that relate to the right of way or servitudes in favour of municipality for service area. The servitudes diagrams are showed in most of the surveyor diagrams and there are specific diagrams prepared to show servitudes (servitude diagrams).

4. CONCLUSION

We started this paper with an overview of land administration in general and then presented the specific case of land administration in South Africa. An overview of the LADM and its three main packages was provided before we presented a first draft of the LADM profile for South Africa. This work is part of a research project to investigate the use of LADM in South Africa. Initial findings show that it is possible to develop a profile of LADM for South Africa.

The ultimate purpose of the research project is to derive a complete profile of the LADM standard that is suitable for South African land administration systems. The complete profile is still under construction due late delivery of sample data of other relevant documents from the relevant organisations. However, the information used sufficient to conclude that the LADM profile for South Africa is possible. The construction of the profile will be completed.

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