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Geographic information — Land Administration Domain Model (LADM)

Information géographique — Modèle du domaine de l'administration des terres (LADM)

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Contents

Page

Foreword

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ISO 19152 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

Introduction

This International Standard defines the Land Administration Domain Model (LADM). The LADM is a conceptual model, and not a data product specification (in the sense of ISO 19131).

The purpose of the LADM is not to replace existing systems, but rather to provide a formal language for describing them, so that their similarities and differences can be better understood. This is a descriptive standard, not a prescriptive standard.

Land administration is a large field; the focus of this International Standard is on that part of land administration that is interested in rights, responsibilities and restrictions affecting land (or water), and the geometrical (geospatial) components thereof. The LADM provides a reference model which will serve two goals:

— to provide an extensible basis for the development and refinement of efficient and effective land administration systems, based on a Model Driven Architecture (MDA), and

— to enable involved parties, both within one country and between different countries, to communicate, based on the shared vocabulary (that is, an ontology), implied by the model.

The second goal is relevant for creating standardized information services in a national or international context, where land administration domain semantics have to be shared between regions, or countries, in order to enable necessary translations. Four considerations during the design of the model were that:

— it will cover the common aspects of land administration all over the world;

— it will be based on the conceptual framework of 'Cadastre 2014' of the International Federation of Surveyors (FIG) [14];

— it will be as simple as possible in order to be useful in practice;

— the geospatial aspects follow the ISO/TC 211 conceptual model.

Until now, most countries (or states, or provinces) have developed their own land administration system. One country operates a deeds registration system, another a title registration system. Some systems are centralized, and others decentralized. Some systems are based on a general boundaries approach, others on fixed boundaries. Some systems have a fiscal background, others a legal one. The different implementations (foundations) of the various land administration systems do not make meaningful communication across borders easy. However, looking from a distance, one will observe that the different systems are in principle largely the same: they are all based on the relationships between people and land, linked by (ownership or use) rights, and are in most countries influenced by developments in Information and Communication Technology (ICT). Furthermore, the two main functions of every land administration (including cadastre and/or land registry) are:

— keeping the contents of these relationships up-to-date (based on regulations and related transactions); and

— providing information from the (national) registers.

Land administration is described as the process of determining, recording and disseminating information about the relationship between people and land. If ownership is understood as the mechanism through which rights to land are held, we can also speak about land tenure. A main characteristic of land tenure is that it reflects a social relationship regarding rights to land, which means that in a certain jurisdiction the relationship between people and land is recognised as a legally valid one. These recognised rights are in principle eligible

for registration, with the purpose being to assign a certain legal meaning to the registered right (e.g. a title). Therefore, land administration systems are not just 'handling geographic information', as they represent a lawfully meaningful relationship amongst people, and between people and land.

As land administration activity on the one hand deals with huge amounts of data, which moreover are of a dynamic nature, and on the other hand requires a continuous maintenance process, then the role of ICT is of strategic importance. Without the availability of information systems it will be difficult to guarantee good performance with respect to meeting changing customer demands. Organizations are now increasingly confronted with rapid developments in technology, a technology push (the Internet, geospatial databases, modelling standards, open systems, and GIS), as well with a growing demand for new services, a market pull (e-governance, sustainable development, electronic conveyance, and the integration of public data and systems). Modelling is a basic tool, facilitating appropriate system development and reengineering and, in addition, it forms the basis for meaningful communication between different systems.

Standardization has become a well-known process in the work of land administrations and land registries. In both paper-based systems and computerized systems, standards are required to identify objects, transactions, relationships between objects (e.g. parcels, generally referred to as spatial units) and persons (e.g. citizens, legally referred to as subjects and generally referred to as parties), classification of land use, land value, map representations of objects, and so on. Computerized systems require further standardization when topology and the identification of single boundaries are introduced. In existing land administrations and land registries, standardization is generally limited to the region, or jurisdiction, where the land administration (including cadastre and/or land registry) is in operation. Open markets, globalization, and effective and efficient development and maintenance of flexible (generic) systems, require further standardization.

The scope of this International Standard is provided in Clause 1. Conformance in relation to this International Standard is given in Clause 2, and a conformance test is specified in Annex A. Normative references are presented in Clause 3 and the used terms, definitions and abbreviations in Clause 4. Clause 5 gives a global overview of packages. Clause 6 introduces the classes, attributes and associations in detail. Annex B explains the 2D and 3D representations of spatial units. A comprehensive set of informative examples (using instance level classes) is available in Annex C.

It must be noted that this is a generic domain model. It is expandable and it is likely that additional attributes, operators, associations, and perhaps even additional classes, will be needed for a specific region or country; see the country profiles in Annex D. Specific parts of the LADM are further detailed: the spatial profiles in Annex E and the legal profiles in Annex F. Some examples of using the LADM in a specific context are: the INSPIRE cadastral parcels in Annex G, the integration of the LADM with the agricultural Land Parcel Identification Systems (LPIS) of the European Union in Annex H, and the Social Tenure Domain Model (STDM) in Annex I. It is possible to use only a subset, or profile, of the LADM for a specific implementation.

Annex J gives an overview of code tables as a basis to describe a flexible enumeration.

The construction of external databases with party data, address data, taxation data, land use data, land cover data, valuation data, physical utility network data, and archive data, is outside the scope of the LADM. However, the LADM provides stereotype classes for these data sets (if available), see Annex K. Interface classes are in Annex L. Annex M makes some remarks in relation to process models. History and dynamic aspects are included in Annex N. Annex O explains the link to other ISO international standards.

Geographic information — Land Administration Domain Model (LADM)

1 Scope

This International Standard:

— defines a reference Land Administration Domain Model (LADM) covering basic information-related components of land administration (including those over water and land, and elements above and below the surface of the earth);

— provides an abstract, conceptual model with four packages related to

1) parties (people and organizations);

2) basic administrative units, rights, responsibilities, and restrictions (ownership rights);

3) spatial units (parcels, and the legal space of buildings and utility networks);

4) spatial sources (surveying), and spatial representations (geometry and topology);

— provides terminology for land administration, based on various national and international systems, that is as simple as possible in order to be useful in practice. The terminology allows a shared description of different formal or informal practices and procedures in various jurisdictions;

— provides a basis for national and regional profiles; and

— enables the combining of land administration information from different sources in a coherent manner.

The following is outside the scope of this International Standard:

— interference with (national) land administration laws that may have any legal implications;

— construction of external databases with party data, address data, valuation data, land use data, land cover data, physical utility network data, archive data and taxation data. However, the LADM provides stereotype classes for these data sets to indicate which data set elements the LADM expects from these external sources, if available; and

— modelling of land administration processes.

2 Conformance

The LADM consists of three packages and one subpackage, and for each of them a conformance test is specified in Annex A. Three conformance levels are specified per (sub)package: level 1 (low level), level 2 (medium level), and level 3 (high level). Level 1 tests the basic classes per package and level 2 also includes the more common classes. Level 3 includes all classes. Any LADM claiming conformance to this International Standard shall satisfy the requirements of Annex A.

3 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4217:2008, *Codes for the representation of currencies and funds*

ISO 8601:2004, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 13240:2001, *Information technology — Document description and processing languages — Interchange Standard for Multimedia Interactive Documents (ISMID)*

ISO 14825:2011, *Intelligent transport systems — Geographic Data Files (GDF) — GDF5.0*

ISO/TS 19103:2005, *Geographic Information — Conceptual schema language*

ISO 19105:2000, *Geographic Information — Conformance and testing*

ISO 19107:2003, *Geographic Information — Spatial schema*

ISO 19108:2002, *Geographic Information — Temporal schema*

ISO 19111:2007, *Geographic Information — Spatial referencing by coordinates*

ISO 19115:2003, *Geographic information — Metadata*

ISO 19125-2:2004, *Geographic information — Simple feature access — Part 2: SQL option*

ISO 19156:2011, *Geographic information — Observations and measurements*

4 Terms, definitions, and abbreviations

4.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1.1
administrative source
source (4.1.21) with the administrative description (where applicable) of the **parties** (4.1.13) involved, the **rights** (4.1.20), **restrictions** (4.1.19) and **responsibilities** (4.1.18) created and the **basic administrative units** (4.1.2) affected

EXAMPLE 1 It is the evidence of a party's right to a basic administrative unit.

EXAMPLE 2 A document describing a transaction (a deed), or a judgement of the register holder.

4.1.2
basic administrative unit
baunit
administrative entity, subject to registration (by law), or recordation [by informal **right** (4.1.20), or customary right, or another social tenure relationship], consisting of zero or more **spatial units** (4.1.23) against which (one or more) unique and homogeneous rights [e.g. ownership right or **land** (4.1.9) use right], **responsibilities** (4.1.18) or **restrictions** (4.1.19) are associated to the whole entity, as included in a **land administration** (4.1.10) system

NOTE 1 'Unique' means that a right, restriction, or responsibility is held by one or more **parties** (4.1.13) (e.g. owners or users) for the whole basic administrative unit. 'Homogeneous' means that a right, restriction or responsibility (e.g. ownership, use, social tenure, lease, or easement) affects the whole basic administrative unit. For a restriction, zero parties are a possibility.

NOTE 2 A basic administrative unit may play the role of party, e.g. when the right holder is a basic administrative unit (and not a person or organization).

NOTE 3 A baunit should get a unique identifier when registered, or recorded.

NOTE 4 A baunit can consist of zero spatial units, when a registry exists, and not a cadastre.

NOTE 5 Restrictions and responsibilities can be associated with their own baunits, each with their own type of spatial unit.

EXAMPLE A condominium unit comprising two spatial units (e.g. an apartment and a garage), a farm lot comprising one spatial unit (e.g. parcel of land), a servitude comprising one spatial unit (e.g. the road representing the right-of-way), a land consolidation area, or a right-of-use unit with several right holders and restricted objects.

4.1.3
boundary
set that represents the limit of an entity

[ISO 19107:2003, 4.4]

NOTE Boundary is most commonly used in the context of geometry, where the set is a collection of points or a collection of objects that represent those points. In other arenas, the term is used metaphorically to describe the transition between an entity and the rest of its domain of discourse.

4.1.4
boundary face
face (4.1.7) that is used in the 3-dimensional representation of a **boundary** (4.1.3) of a **spatial unit** (4.1.23)

NOTE Boundary faces are used when the implied vertical and unbounded faces of a **boundary face string** (4.1.5) are not sufficient to describe 3D spatial units. Boundary faces close volumes in height (e.g. every apartment floor), or in depth (e.g. an underground parking garage), or in all other directions to form a bounded volume. The volumes represent legal space (in contrast with physical space).

4.1.5
boundary face string
boundary (4.1.3) forming part of the outside of a **spatial unit** (4.1.23)

NOTE Boundary face strings are used to represent the boundaries of spatial units by means of line strings in 2D. This 2D representation is a 2D boundary in a 2D **land administration** (4.1.10) system. In a 3D land administration system it represents a series of vertical **boundary faces** (4.1.4) where an unbounded volume is assumed, surrounded by boundary faces which intersect the Earth's surface (such as traditionally depicted in the cadastral map).

4.1.6
building unit
component of building (the legal, recorded or informal space of the physical entity)

NOTE A building unit may be used for different purposes (e.g. living or commercial) or it can be under construction.

EXAMPLE An apartment, a flight of stairs, a threshold, a garage, a parking space or a laundry space.

4.1.7
face
2-dimensional topological primitive

[ISO 19107:2003, 4.38]

NOTE The geometric realization of a face is a surface. The boundary of a face is the set of directed edges within the same topological complex that are associated to the face via the boundary relations. These can be organized as rings.

4.1.8
group party
any number of **parties** (4.1.13), together forming a distinct entity, with each party registered

NOTE A group party may be a **party member** (4.1.14) of another group party.

EXAMPLE A partnership (with each partner registered as a party), or two tribes (with each tribe registered as a party).

4.1.9
land
the surface of the Earth, the materials beneath, the air above and all things fixed to the soil

[UN/ECE, 2004]

4.1.10
land administration
process of determining, recording and disseminating information about the relationship between people and **land** (4.1.9)

NOTE In many countries, land administration information is determined, recorded and disseminated under the umbrella of cadastre and land registry. Both institutions can be unified in a single (state) organization.

4.1.11
level
set of **spatial units** (4.1.23), with a geometric, and/or topological, and/or thematic coherence

EXAMPLE 1 One level of spatial units for an urban cadastre and another for spatial units for a rural cadastre.

EXAMPLE 2 One level of spatial units to define **basic administrative units** (4.1.2) associated with **rights** (4.1.20) and another level of spatial units to define basic administrative units associated with **restrictions** (4.1.19).

EXAMPLE 3 One level of spatial units to define basic administrative units associated with formal rights, a second level for spatial units to define basic administrative units associated with informal rights and a third level for spatial units to define basic administrative units associated with customary rights.

EXAMPLE 4 One level with **point** (4.1.15) based spatial units, a second level with line based spatial units, and a third level with polygon based spatial units.

4.1.12
liminal spatial unit
spatial unit (4.1.23) on the threshold between 2D and 3D representations

4.1.13
party
person or organization that plays a role in a **rights** (4.1.20) transaction

NOTE 1 In order to be registered as a party, not all members need to be identified and registered individually.

NOTE 2 A **basic administrative unit** (4.1.2) may be a party because it may hold a right of e.g. easement.

EXAMPLE An organization may be: a company, a municipality, the state, a tribe, a farmer cooperation, or a church community (with each organization represented by a delegate: a director, chief, CEO, etc.).

4.1.14
party member
party (4.1.13) registered and identified as a constituent of a **group party** (4.1.8)

4.1.15
point
0-dimensional geometric primitive, representing a position

[ISO 19107:2003, 4.61]

NOTE 1 A point may be used to define one or more **boundary faces** (4.1.4) or **boundary face strings** (4.1.5).

NOTE 2 Points can be observed by, e.g. terrestrial surveying, but also by photo interpretation, image interpretation, or identification on an existing map.

4.1.16
profile
set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards, that are necessary for accomplishing a particular function

[ISO 19106:2004, 4.5]

NOTE 1 A profile valid for a whole country is named a country profile (see Annex D).

NOTE 2 A profile is derived from base standards so that by definition, conformance to a profile is conformance to the base standards from which it is derived (see Annex A).

4.1.17
required relationship
explicit association between either **spatial units** (4.1.23), or between **basic administrative units** (4.1.2)

NOTE 1 Due to legal aspects, history of data, inaccurate geometries or missing geometries, geospatial overlay techniques may generate invalid, or no relationships between spatial units, which can be introduced by required relationships.

NOTE 2 Relationships for spatial units may be defined with ISO 19125-2 types.

4.1.18
responsibility
formal or informal obligation to do something

EXAMPLE The responsibility to clean a ditch, to keep a snow-free pavement or to remove icicles from the roof during winter, or to maintain a monument.

4.1.19
restriction
formal or informal obligation to refrain from doing something

EXAMPLE 1 It is not allowed to build within 200 metres of a fuel station; or, a servitude or mortgage as a restriction to the ownership **right** (4.1.20).

EXAMPLE 2 Sequestration can be registered for baunit as a restriction.

4.1.20
right
action, activity or class of actions that a system participant may perform on or using an associated resource

[ISO 19132:2007, 4.38]

NOTE 1 A right may provide a formal or informal entitlement to own or do something.

NOTE 2 This International Standard deals with real rights and personal rights. Real rights are rights over or in respect of **spatial units** (4.1.23) (e.g. ownership, or usufruct). Personal rights are rights that **parties** (4.1.13) have (e.g. fishing rights, grazing rights, or use rights).

NOTE 3 Rights may be overlapping, or may be in disagreement.

EXAMPLE Ownership right, apartment right, tenancy right, possessions, customary right, Islamic right (e.g. miri or milk), indigenous right, or informal right.

4.1.21
source
document providing legal and/or administrative facts on which the land administration (LA) object [**right** (4.1.20), **restriction** (4.1.19), **responsibility** (4.1.18), **basic administrative unit** (4.1.2), **party** (4.1.13), or **spatial unit** (4.1.23)] is based

NOTE Any kind of document may be added as a source according to ISO 19115:2003, B.3.2.

4.1.22
spatial source
source (4.1.21) with the spatial representation of one (part of) or more **spatial units** (4.1.23)

EXAMPLE A field survey sketch, an orthophoto or a satellite image with evidence of the location of boundaries (collected from the field).

4.1.23
spatial unit
single area (or multiple areas) of **land** (4.1.9) and/or water, or a single volume (or multiple volumes) of space

NOTE 1 A single area is the norm and multiple areas are the exception.

NOTE 2 Spatial units are structured in a way to support the creation and management of **basic administrative units** (4.1.2).

NOTE 3 This International Standard supports either 2-dimensional (2D), 3-dimensional (3D), or mixed (2D and 3D) representations of spatial units, which may be described in text ("from this tree to that river"), or based on a single **point** (4.1.15), or represented as a set of unstructured lines, or as a surface, or as a 3D volume.

NOTE 4 In addition to spatial units represented by a single point, text, or a set of unstructured lines, a spatial unit may have an area equal to zero for administrative reasons.

4.1.24
spatial unit group
any number of **spatial units** (4.1.23), considered as an entity

NOTE The spatial units in a spatial unit group are not necessarily continuous.

EXAMPLE Spatial units together forming an administrative zone such as a section, a canton, a municipality, a department, a province, or a country. Spatial units within a planning area.

4.1.25
utility network
network describing the legal space of the topology of a utility

NOTE 1 A utility network may be attributed with information about its legal, recorded or informal space.

NOTE 2 A utility network can also be modelled as a **basic administrative unit** (4.1.2).

EXAMPLE The legal space needed to access and to keep in repair a cable or pipeline utility network.

4.2 Abbreviations

baunit	basic administrative unit
FIG	International Federation of Surveyors
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
INSPIRE	Infrastructure for Spatial Information in Europe