The first five parts of LADM Edition II have been published as ISO standards now

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Key words: LADM, Land Administration Domain Model, land administration, cadastre, digital cadastre, e-Governance, marine cadastre, standards, land registration, valuation information, spatial plan information

SUMMARY

The Land Administration Domain Model (LADM), originally published as ISO 19152:2012, has undergone a systematic revision in response to demands from domain experts in land administration. As of 2025, the first five parts of the second edition of LADM have been published as ISO standards. This milestone marks a major step forward in providing modular, extensible, and internationally harmonised frameworks for the modelling of land administration systems. The newly published parts include Part 1 – Generic conceptual model, Part 2 – Land registration, Part 3 – Marine georegulation, Part 4 – Valuation information and Part 5 – Spatial plan information. Each part addresses a distinct aspect of land administration while remaining interconnected through a shared conceptual foundation. This paper will focus on the recent developments on LADM Edition II, namely publication of first five parts of LADM Edition II and introduce each published parts briefly. Together, these five parts significantly enhance the usability and relevance of the LADM standard across a broad spectrum of applications, from cadastral data management and urban planning to property valuation and marine cadastre. They provide a foundation for the development of digital land administration ecosystems, improve the quality and comparability of land-related data, and support international efforts to achieve Sustainable Development Goals (SDGs). The modularisation of the standard also allows countries and organizations to implement the parts, depending on their specific needs and capacities, while still ensuring semantic consistency. The publication of the first five parts of LADM Edition II represents not only technical advancement but also a strategic opportunity for countries to modernise their land administration infrastructure in alignment with international best practices. It opens new pathways for integration between cadastral, marine, valuation, and spatial plan systems, thereby improving land governance, reducing disputes, and enabling data-driven policy development. The paper includes an overview the most important changes in the new edition compared to the edition published in 2012.

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1. INTRODUCTION

The Land Administration Domain Model (LADM), originally published as ISO 19152:2012, has undergone a systematic revision in response to demands from domain experts in land administration. As of 2025, the first five parts of the second edition of LADM have been formally published as ISO standards. This milestone marks a major step forward in providing modular, extensible, and internationally harmonized frameworks for the modelling of land administration systems. The newly published parts include:

- ISO 19152-1:2024 Geographic information – Land Administration Domain Model (LADM) – Part 1: Generic conceptual model
- ISO 19152-2:2025 Geographic information – Land Administration Domain Model (LADM) – Part 2: Land registration
- ISO 19152-3:2024 Geographic information – Land Administration Domain Model (LADM) – Part 3: Marine georegulation
- ISO 19152-4:2024 Geographic information – Land Administration Domain Model (LADM) – Part 4: Valuation information, and:
- ISO 19152-5:2024 Geographic information – Land Administration Domain Model (LADM) – Part 5: Spatial plan information.

The LADM standard is a universal, conceptual information model that covers basic information-related components of land administration. It involves information on 'people to land relationships'. The new edition is needed because ISO requires all standards to be regularly reviewed to see whether user requirements are still met or if extensions are needed.
The key benefit of LADM is that a common language is available enabling communication between experts, especially between land administration experts (as surveyors, notaries, lawyers, planners, valuers, bank employees, brokers, colleagues in governments) and IT experts and experts from the GIS and DBMS industry. Further benefits are in the possible use of country profiles, participatory approaches and the management of conflicts.
LADM supports the creation of overview of responsibilities in initial data collection and maintenance of involved organisations: cadastre, land registry, valuation department, municipalities, surveyors, etc. The model facilitates database design, system development, but above all interoperability in land data. Enabled by LADM, this allows different systems to seamlessly share and use land-related information, benefiting governments, communities, and businesses. LADM supports the creation of nationwide overview of responsibilities and required coordination in land administration.

Figure 1. Participants at the 12th International FIG Workshop on LADM & 3D LA, 24-26 September 2024, Kuching, Malaysia

The development of an LADM is based on user demands, providing a solid foundation. These demands are derived from global guidelines and requirements, as well as from the outcomes of several LADM and 3D Cadastre workshops. Figure 1 shows the participants of the LADM 2024 Workshop in Malaysia. The general demands are briefly outlined in section 2 of this paper, along with more specific demands from the perspectives of land tenure, land value, and planned land use. Section 3 provides an overview of the new edition of the LADM. The LADM packages on parties, RRRs (rights, restrictions and responsibilities), spatial units, land survey, valuation information and spatial plan information on planned land use ar presented, the different parts are briefly introduced. Section 4 is on integration and interoperability. The diagrams of the different packages are shown in a distributed environment and are then integrated in a complete overview class diagram with associations between classes in packages. In section 5 an overview is given on the main changes in the new Edition compared to the ISO 19152:2012. Section 6 discusses the advantages of the LADM. The paper closes with the introduction of two new publications on LADM by the International Federation of Surveyors (FIG).

2. USER REQUIREMENTS

The development of the new edition of LADM is explicitly based on user demands. These demands are derived from global guidelines and requirements, as well as from the outcomes of several LADM and 3D Cadastre workshops. The user demands, or requirements are categorised into ‘general demands’, demands related to ‘land tenure’, demands related to ‘land value’ and demands related to ‘land use plan’. This is categorisation is based on Enemark (2005). For the overview and more details of demands listed below see also (Lemmen et al., 2025a). Some of the demands are already used in ISO 19152:2012 while others are new, for example demands related to valuation information or information on land use.
Each demand in the list is accompanied by a brief explanation of its implementation or of related functionalities in LADM.
General demands:

- *all functions of land administration are supported: land tenure, land value, land use and development*. In Enemark (2005), land tenure is described as the allocation and security of rights to land. This includes legal investigations, transfer of ownership and management of disputes. Land value is the assessment of value of land; taxation and the

management of disputes. Land use concerns the control of land use through the adoption of planning policies and land use regulations at national, regional and local levels; the enforcement of land use regulations; and the management (monitoring) of land use conflicts. The functions of land tenure, land value and planned land use are modelled in LADM Parts 2, 4 and 5 as separate, but interrelated, standards,

- *land includes water, air or space and subsurface spaces,* and: *land and water information are managed and used in an integrated environment*. In LADM, land includes the representation of water, air or space and subsurface spaces. This is defined in the scope of part 1 (ISO 19152-1:2024). In the previous edition of LADM the term "land administration" was used in the broad sense. In the new edition, a new term, with a wider meaning is introduced: "georegulation". This is defined as an activity to delineate geographical spaces and to assert control over them through regulation,
- *all initial information and all information updates are source based, all extracted information in a DBMS (register) is linked to sources.* And: *spatial source information is obtained from survey or design (BIM).* LADM is designed in such a way that all initial, new and changed information should be source based in principle, all extracted information in a DBMS (register) is linked to sources. Administrative sources can be a deed or a title, a spatial source can be for example a field survey sketch (or plan), an orthophoto or satellite image including evidence on the location of boundaries (collected in the field). Conversions from legitimate to legal rights may have their own specific type of source document. This may concern social tenure relations that have legitimacy but are not yet legally recognised and, for that reason, cannot be institutionalised. The related spatial units and right holders can be documented in order to get overview of the existing situation and to prepare conversions of legitimate to legal rights,
- *code lists can be used.* Code lists offer a lot of flexibility. A code list in Unified Modeling Language (UML), a simple list of values without any structure, can be employed as a simple data type to further capture the semantics of a domain (Kara et al., 2022),
- *history of information can be managed, updates are traceable.* Users may not only be interested at the current state of objects, but may also need access to historic versions of these objects. To accommodate this, LADM uses versioned objects and time stamps. This approach works within a (spatial) information infrastructure, where multiple authorities maintain different but related information,
- *spatial units can be in 2D, 3D, with or without topology*. Spatial units (parcels) can be represented in LADM in 1D, 2D, 2.5D or 3D. Possible representations of spatial units in an LADM-based system range from volumes, polygons, line sets to points. It is also possible to refer to street axes or use video to describe the spatial unit. A 3D representation is particularly necessary in urban environments with subsurface infrastructure for utilities and complex buildings,
- *changes in reference systems are accommodated.* Changes in reference systems can be managed in LADM (from information perspective) by means of versioned objects,
- *all objects have a unique id and a quality label, external information can be linked.* All objects (parties, RRRs, spatial units, etc.) have unique id's in LADM as well as an optional quality label. External information can be, for example, in the municipality or in the chamber of commerce and can be linked in information infrastructure,

- *information can be kept to the custodian, within (spatial) information infrastructures.* And: *implementation as a distributed data set is possible.* In LADM, implementation as a distributed information set is possible where needed,
- *formalisation and computation of relevant SDG indicators is supported.* Chen et al. (2025) explore how ISO 19152 LADM provides a unified technical foundation to model and monitor global land indicators. A standardised conceptual model with UML-based implementation is developed and a modular indicator computation architecture based on interface classes and reusable logic components is proposed. The proposed approach supports scalable reporting, enhances indicator operationalisation, and bridges the gap between global policy frameworks and national land administration systems. See Chen et al. (2024) and Kara et al. (2024b), and:
- *editions are backwards compatible.* The new edition is backwards compatible to the ISO 19152:2012 version of the LADM. Any country profile established using the elements defined in accordance with this version remains compliant with the new edition of the LADM, as the main changes do not affect the main structure of the model given in ISO 19152:2012.

Demands on representation of land tenure:

- *the triple 'party – RRR – spatial unit' can be represented and managed (people to land relations).* A land title is related to a person(s) and also to a bounded area of land. The same should apply to the standardised representation of this reality in a register and on a map. Those 'people to land relationships' are represented in the so called 'triple' in LADM. That is a 'party' related to a 'right' and a 'right' related to a 'spatial unit', this is the common pattern for land administration and is the basic structure,
- *spatial units with same RRRs can be grouped in basic administrative units (property units).* Spatial units can be grouped in basic administrative units (property units) when RRRs are the same for all spatial units. The term 'basic administrative units' is derived from the term 'basic property unit', see Dale and McLaughlin (1999). Because properties require formal registration the term 'basic administrative units' is used in LADM because it may include informal registrations,
- *the implementation of the continuum of land rights is supported.* People to land relationships appear in different ways, depending on local tradition, culture, religion and behaviour. LADM 'merges' the representation of formal and informal tenure systems into one environment. Land rights may be formal ownership, apartment right, usufruct, freehold, leasehold, etc. It may be social tenure relationships like occupation, tenancy, non-formal rights, customary rights, indigenous rights, possession, etc. There may be recordation (or registration) of overlapping tenures, claims, disagreement and conflict situations which must be resolved and which must therefore be depicted. See UN-HABITAT (2008). Women's access to land can be arranged, there is for example support in conversion of use rights, to formal rights, see Unger et al. (2023),
- fit-for-purpose LA approaches and Cadastre 2014 implementation are supported. Fit-For-Purpose land administration approaches are supported (Enemark et al., 2014 Enemark et al., 2021). Conversion from legitimate to legal rights can be guided. The implementation of Cadastre 2014 (Kaufmann and Steudler, 1998) is supported from an information management perspective. Information collectors can be "of type" (represented in Codelists) grassroots or paralegals. Or licensed surveyors or registrars.

Information can be collected in the field or in a village using high or low resolution imagery defining visible boundaries. There can be different mapping tools, such as total stations, GNSS antennas or mobile devices; even tapes or plane tables,

- *persons responsible for transactions can be included in the source information.* Using code lists different types of supporting persons can be identified and represented: notaries, majors, judges, chiefs, etc.,
- *all types of parties and groups of them can be used,* this ranges from groups (or groups of groups) as right holders to individuals. Groups can have defined or non-defined membership. A right holder can be an individual or company, a married couple holding shares in a right etc. Or a cooperative where individuals may have a share,
- *there can be shares in group membership and there can be shares in RRRs.* A denominator/numerator type of fraction can be used in order to express a share exactly, for example three parties each have an equal share of 1/3, and:
- *participatory data collection is supported.* This concerns approaches where people collect their own land data with support of professionals. See Morales et al. (2021).

Demands on representation of land value:

- *determination of the value is in accordance with published procedures.* The LADM valuation information standard is designed in such a way that determination, storage and publication of values can be in accordance with published proceedings,
- *land value can be based on market values, mass appraisal or other valuation approaches.* Land value can be based on market values, mass appraisal, or other valuation approaches. A market value approach is based on the highest price that a buyer will pay and at the same time the lowest price a seller will accept. Mass appraisal means valuing a group of properties at a certain moment in time, using standard methods, employing common data, and allowing for statistical testing. The required information can be stored using LADM,
- *registration of transaction prices and sales statistics publication are supported.* The registration of transaction prices and sales statistics publication are supported in LADM. The sale price of a property can be seen as a transaction price. The type of transaction may be an exchange, family transfer, forced sale, inheritance, open market sale, voluntary transfer, etc.,
- *information on valuation units can be recorded and shared with society.* In LADM, valuation is the process of estimating the value of any administrative unit, typically the BAUnit (see next section). This may be a group of spatial units, where a building or an apartment can be a spatial unit. Information on valuation units can be recorded and shared with society, see Kara et al., (2023), and:
- *timely and effective dissemination of property values and input information for valuation to the general public is supported.* Timely and effective dissemination of property values and input information for valuation to the public is supported for transparency and fairness reasons, see Kara et al., (2023).

Demands on representation of land use (spatial plans):

- *plan units can be organised in plan blocks ('accepted lowest level plans').* In LADM it is possible to organise plan units in plan blocks. A plan unit is a homogenous area/space with an assigned function or purpose representing the potential for land use

development. This pertains to the largest scale, typically at the municipality level, where the lowest-level plans (as approved by the authorities) are implemented,
- *registration of permits is supported.* A permit can be considered as an authorisation. This authorisation is granted by the authorities in accordance with the function of the plan unit. It might be suitable to use plan unit identifiers in a permit document,
- *spatial functions of plan units and blocks is based on code lists.* Allowed or intended spatial function types (e.g. agriculture zone, condominium zone, culture zone, etc) of plan units and blocks can be based on extensible code lists. This allows for representation of locally agreed functions, zones and classifications,
- *a planning hierarchy from national to local plans is supported via plan groups ('accepted higher level plans').* A plan is a set of documents and zoning maps that establish the strategic spatial development direction of an area. A planning hierarchy exists from national to local spatial plans: e.g. national/federal, regional/state, municipality/city, neighbourhood, and so forth. Representation of this hierarchy is supported via plan groups with specific attributes for the administrative subdivision,
- *open dissemination and visualisation of plan information is supported.* Timely and effective dissemination of property values is an essential part of a transparent and efficient planning information system. 3D valuation units (e.g., condominium) and groups (aggregation of valuation units, e.g., a building floor in a multi-occupied building, a multi-occupied building, street, district or valuation zone) may be required in visualisation to better communicate with users. See Kara et al., (2023), and:
- *participatory plan monitoring is supported to avoid illegal development.* Participatory plan monitoring can be used to report possible illegal and negative developments against approved plans, to detect challenges and to evaluate alternative scenarios.

3. OVERVIEW OF THE NEW LADM EDITION

As indicated in the introduction, the new edition of LADM has been published in five parts, which are discussed in more detail in this section. This followed by an overview of new and inherited (from Edition I) packages. Relations between packages and the different parts of Edition II are visualised.

Regarding the colouring of classes in LADM UML diagrams: the green colour is chosen for the Party package, while yellow and turquoise are chosen for the Administrative and Spatial Unit packages respectively, as well as light pink is used for the Surveying and Representation sub-package (in-line with the colouring of the respective classes of LADM Edition I). For the parts introduced in the new Edition, different colours are used; the packages of Part 3 are coloured in grey, while Part 4 and Part 5 are coloured orange and light blue respectively.

The new Edition II is multipart:

Part 1 (ISO 19152-1:2024), *'Generic conceptual model',* is designed as a high-level umbrella standard that supports all the other parts of the LADM Edition II. It includes overview for each proposed part of LADM Edition II (Parts 2, 3, 4 and 5). It introduces the fundamental notions and basic concepts of LA and only includes the characteristics of the LADM Special Classes: VersionedObject and LA_Source. The abstract class VersionedObject is introduced to manage and maintain versioned data. All LADM classes (directly or indirectly) inherit from VersionedObject except for LA_Source. The LA_Source class is introduced in order to support

any kind of source. In order to version the instances of LA_Source, association relationships are specified between the VersionedObject and LA_Source. All the concepts and definitions given Part 1 (ISO 19152-1:2024) are used as basis by the other parts of LADM Edition II.
Part 2 is on *'Land registration'*. The LADM Edition I concentrated on the land registration, which is now addressed in the Part 2 of the new Edition (ISO 19152-2:2025) with some refinements: new subclasses for LA_SpatialUnit, refined survey model (derived from OGC's LandInfra/InfraGML standard), semantically enriched and versioned code list (metamodel for refined code list using the definitions of SKOS), integration of the LADM and OGC's IndoorGML, a set of possible representations of spatial units in 2D, 3D or mixed dimension, legal spaces in buildings and refined legal profiles.
Part 3 is titled *'Marine georegulation'*. The International Hydrographic Organization (IHO) developed the IHO standard S-121 based on IHO S-100 the Universal Hydrographic Model, which is based on the ISO 19152:2012 LADM. Part 3 (ISO 19152-3:2024) provides a model for representing rights, restrictions and responsibilities (RRRs) within the context of the marine space. This part directly refers to the IHO S-121, its content is similar, only some revisions made to fit ISO template and received comments. Note: the main editorial team of LADM Edition II (the authors of this paper) has not taken a role other than observing the process of this part of LADM.
Part 4 concerns a standard on *'Valuation information'*. Part 4 (ISO 19152-4:2025) is designed to represent all stages of administrative property valuation. It is designed as an extension of core LADM. Part 4 provides a common basis for governments to direct the development of local and national databases and for the private sector to develop information technology products.
Part 5 is about *'Spatial plan information'*. Part 5 (ISO 19152-5:2025) includes planned land use (zoning) information to be converted into rights, restrictions, and responsibilities (RRRs). It enables the integration of the RRRs information from the spatial plan into LADM.
Part 6 – *'Implementation aspects'* is under development in cooperation between OGC, ISO and FIG.
In the new Edition of the LADM the following packages are included:

- Generic Conceptual Model Package: main classes of the Generic Conceptual Model Package are basic classes VersionedObject and LA_Source. Classes are depicted without colour (white). In the new Edition of the LADM this package is introduced in part 1 (ISO 19152-1:2024).
- Party Package: The main class of the Party Package is the basic class LA_Party (with party as an instance). LA_Party has a specialization: LA_GroupParty (with group party as an instance). Between LA_Party and LA_GroupParty there is an optional association class: LA_PartyMember (with party member as an instance). See Figure 2. This package is already included in Edition I of the LADM, its classes are usualy depicted in green. In the new Edition of the LADM tis package is introduced in part 1 (ISO 19152-1:2024).

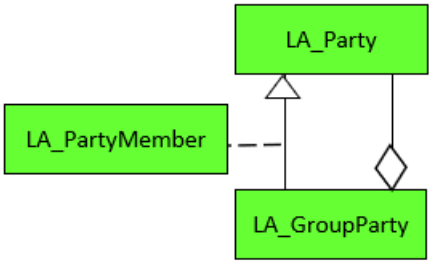

Figure 2. The Party Package in Edition II

- Administrative Package: the main classes of the Administrative Package are basic classes LA_RRR and LA_BAUnit. LA_RRR is an abstract class with three specialization classes: 1) LA_Right. The type of rights depends upon the domain and will be described in more detail in each of the other parts of the ISO 19152 series; 2) The type of restriction depends upon the domain and will be described in more detail in each of the other parts of the ISO 19152 series; 3) LA_Responsibility, The type of responsibility depends upon the domain and will be described in more detail in each of the other parts of the ISO 19152 series. Instances of class LA_BAUnit are basic administrative units (abbreviated as BAUnits). See Figure 3.

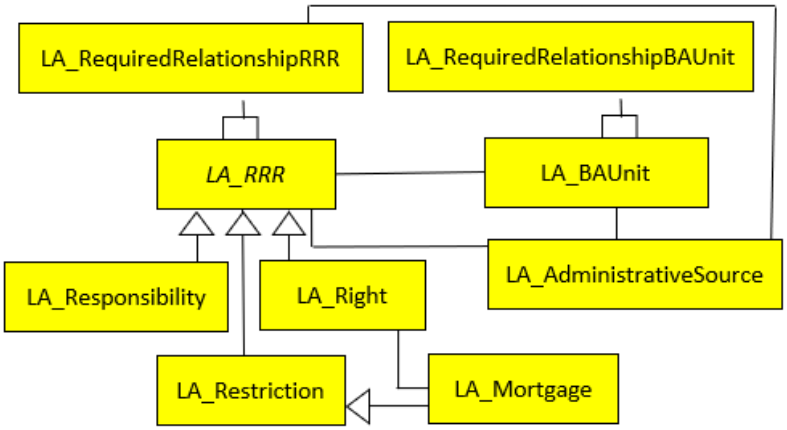

Figure 3. The Administrative Package in Edition II

The BAUnit is a core class of the model and defines the elements upon which rights, restrictions and responsibilities apply. In principle, all rights, restrictions and responsibilities are based on an administrative source, as instances from class LA_AdministrativeSource. The class LA_RequiredRelationshipBAUnit allows for creating relationships between BAUnits. Relationships can be legal, temporal or of a spatial nature. The class LA_RequiredRelationshipRRR allows for creating relationships between RRRs. This package is already included in Edition I of the LADM, its classes are usually depicted in yellow. In new Edition of the LADM this package is introduced in part 1 (ISO 19152-1:2024), except LA_Mortgage which is specific for land registration. The mortgage class is introduced in part 2 of the new Edition (ISO 19152-2:2025). LA_Mortgage is a subclass of LA_Restriction. LA_Mortgage is associated to class LA_Right (the right that is the basis for the mortgage). See Figure 3.

- Spatial Unit Package: the main class of the Spatial Unit Package is the basic class LA_SpatialUnit. Spatial units may be grouped into two forms: 1) As spatial unit groups. Spatial unit groups can be further grouped into larger spatial unit groups. An example of a spatial unit group is a municipality. A spatial unit group may be a grouping of other spatial unit groups. In the implementations of the LADM, this is to enable the inclusion of spatial unit identifiers in hierarchical zones. 2) As sub-spatial units, or subparcels, that is, a grouping of a spatial unit into its parts. Parts, in their turn, may be grouped into subparts (subsubparcels), and so on. An instance of LA_Level is a level, this is a collection of spatial units with a geometric and/or topologic and/or thematic coherence. In Edition II of the LADM this package is introduced in part 1 (ISO 19152-1:2024), except classes LA_LegalSpaceParcel (this is an alias for spatial unit), LA_LegalSpaceBuildingUnit, LA_LegalSpaceUtilityNetworkElement and LA_LegalSpaceCivilEngineeringElement. Those classes are specific for land registration and are, for that reason, introduced in part 2 of the new Edition (ISO 19152-2:2025). See Figure 4.

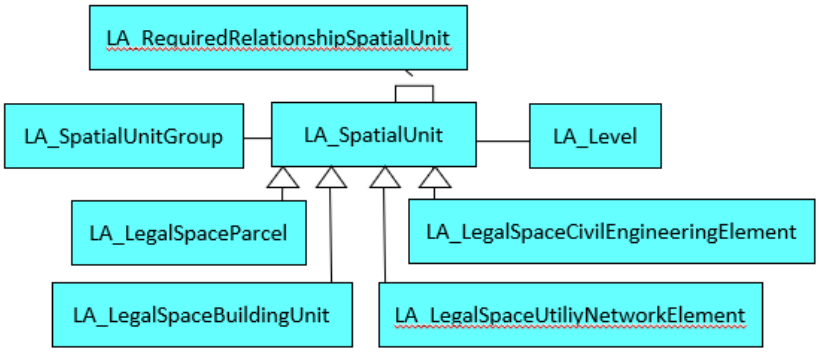

Figure 4. The Spatial Unit Package in Edition II

- Surveying and Representation sub-Package. The sixteen classes of the surveying and representation sub-package are LA_Point, LA_BoundaryFaceString, LA_BoundaryFace, LA_SpatialSource, LA_DesignSource, LA_SurveySource, LA_DistanceObservation, LA_LevelObservation, LA_ImageObservation, LA_AngularObservation, LA_GNSSObservation, LA_ TPSObservation, LA_GPRObservation, LA_MBESObservation, LA_PointCloudObservation, and LA_GNSSCorrection: see Figure 5.

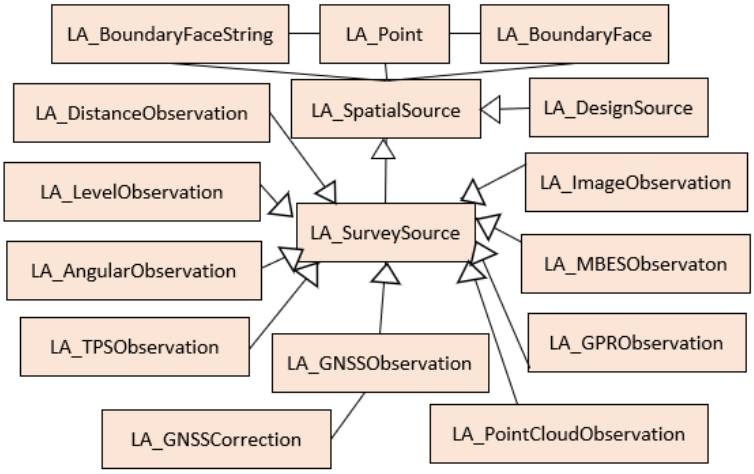

Figure 5. The Survey and Representation Package in Edition II

Except for the LA_Point, LA_BoundaryFaceString, LA_BoundaryFace and LA_SpatialSource classes, which are also included in the LADM Edition I, all classes of the surveying and representation sub-package are introduced in part 2 (ISO 19152-2:2025) of the new Edition: *Land registration.* Points, lines, surfaces and volumes can be acquired in the field (with classical topographic surveys, or with satellite navigation systems), in an office (reusing input from design), or compiled from various sources, for example using forms, field sketches or orthophotos. The acquisition of points, lines, surfaces or volumes (through a topographic survey) can potentially concern the identification of spatial units on a photograph, on an image (orthophoto), or on a topographic map, while cycloramas or pictometry methods (multiple images from different angles) may also be used for that purpose. The LA_SpatialSource class as defined in LADM Edition I, is updated and extended. There are two subclasses of LA_SpatialSource, LA_SurveySource and LA_DesignSource, which provide more insights at the spatial source registered at the system. A survey is documented with survey sources, which are instances from class LA_SurveySource. This may be the final (sometimes formal) documents, or all documents related to a survey. Sometimes, several documents are the result of a single survey. A design document (e.g. building information model) is documented with design sources, which are instances from class LA_DesignSource. A spatial source (survey or design) may be official, or not (i.e. a registered survey plan, or an aerial photograph). Paper-based documents (which may be scanned) can be considered as an integral part of the land administration system Kalogianni, 2024).

- Valuation Information Package. Valuation units may be grouped according to zones (e.g. administrative divisions, market zones) that have similar environmental and economic characteristics or according to the functions of valuation units (e.g. commercial, residential, agricultural). The class VM_SpatialUnit represents land parcel(s) (e.g. cadastral parcel, subparcel, sub-spatial unit) that are subject to valuation. VM_Building, with buildings as instances, includes the building characteristics required in valuation processes (e.g. date of construction, energy performance, use type). A building may be considered as a complementary part of the parcel(s) (VM_SpatialUnit) but may be valued separately from the parcels on which they are located. A building

may represent a condominium building, which consists of a) condominium units (e.g. apartments, shops); b) accessory parts assigned for exclusive use (e.g. garages, storage areas); c) joint facilities covering parcel, structural components (e.g. foundations, roofs), accession areas (e.g. entrance halls, spaces), and other remaining areas of buildings (e.g. staircases, heating rooms). Condominium units, as instances of class VM_CondominiumUnit, are each for the exclusive use of an individual condominium owner and share a condominium building with at least one or more condominium units. VM_Valuation, with valuation information as instances, specifies output data produced within valuation processes. It concerns the date of valuation, value type, the purpose of valuation, valuation approach, and the assessed value of valuation units. See figure 6. The Valuation Information Package is introduced in detail in part 4 (ISO 19152-4:2025) of the new Edition of the LADM.

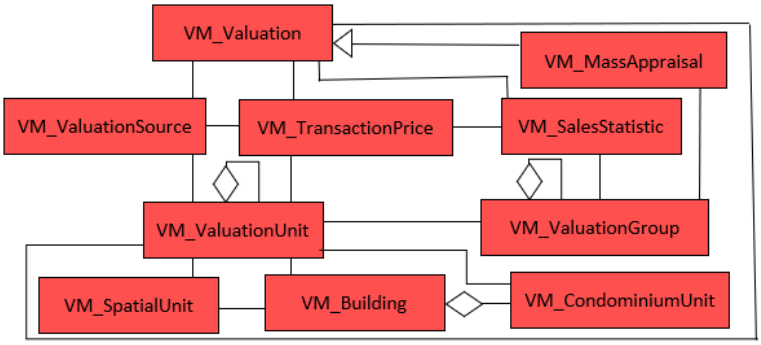

Figure 6. The Valuation Information Package in Edition II

- Spatial Plan Information Package. The spatial plan (SP) information package includes planned land use (zoning) to be converted into RRRs. This package has five classes,

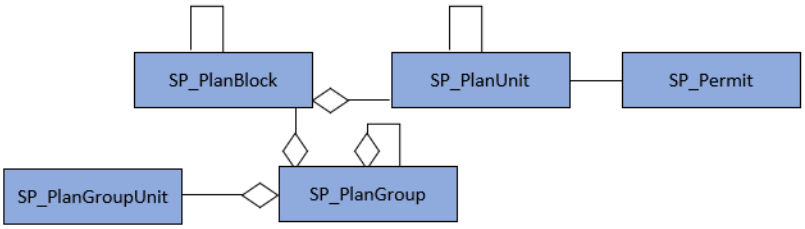

Figure 7. The Spatial Plan Information Package in Edition II

see Figure 7: 1) SP_PlanUnit, this represents homogenous smallest areas/spaces of zoning plans and their characteristics in zoning plan activities, 2) SP_PlanBlock, SP_PlanBlock SP_PlanBlock contains a recommendation or an expected land use with deontic expressions (i.e. permissible/impermissible, obligatory-omissible, optional and ought) for an activity or use or physical development imposed on a spatial unit accommodated in SP_PlanUnit. The SP_PlanUnit contains detailed prescriptions or specifications of activity and physical development at the spatial unit level specified by the spatial planning authority. SP_PlanBlock is the aggregation of one to many instances of SP_PlanUnit, 3) SP_PlanGroup is used to accommodate hierarchy specified by spatial planning authorities, 4) SP_PlanGroupUnit represents the areas corresponding

to the higher planning levels with corresponding boundaries and space functions delineated by the higher plan level authorities; and: 5) SP_Permit, this class t contains permit-related information fitting within the plan. The Spatial Plan Information Package is introduced in detail in part 5 (ISO 19152-5:2025) of the Edition II of the LADM.

Note: part 3 ”Marine georegulation” of the new editions makes use of the core packages defined in ISO 19152-1 together with a package addressing marine georegulation (ISO 19152-3:2024). This package has four subpackages, "MG_PartySection", “MG_Administrative", MG_SpatialUnit" and "MG_ Source". These packages are realisations of the equivalent packages in ISO 19152-1.
In summary: in Part 1 (ISO 19152-1:2024) the terms defined and the party, administrative and spatial unit packages are only introduced, while the detailed description of these packages is included in Part 2 (ISO 19152-2:2025). The “Generic conceptual model” package, which contains the basic requirements on which each part of Edition II is based. The “Survey and representation” sub-package is specified in Part 2. Part 4 and 5 have been designed as a single package, both based on the definitions in Part 1 (ISO 19152-1:2024) and 2 (ISO 19152-2:2025). Part 1 and Part 2 together form an application schema as well as Parts 1, 2, 3, 4 and 5.
Figure 8, from Kara (2024a), depicts the package structure of LADM Edition II, designed in a way that meets the requirements. The “Party”, “Administrative” and “Spatial Unit” packages are common packages in Part 1 (ISO 19152-1:2024) as well as in Part 2 (ISO 19152-2:2025). The newly added packages in Part 3 (ISO 19152-3:2024) are “Party Group” and “Source Group”, in Part 4 (ISO 19152-4:2025) the “Valuation information” package is introduced, while in Part 5 (ISO 19152-5:2025) the “Spatial plan information” package.

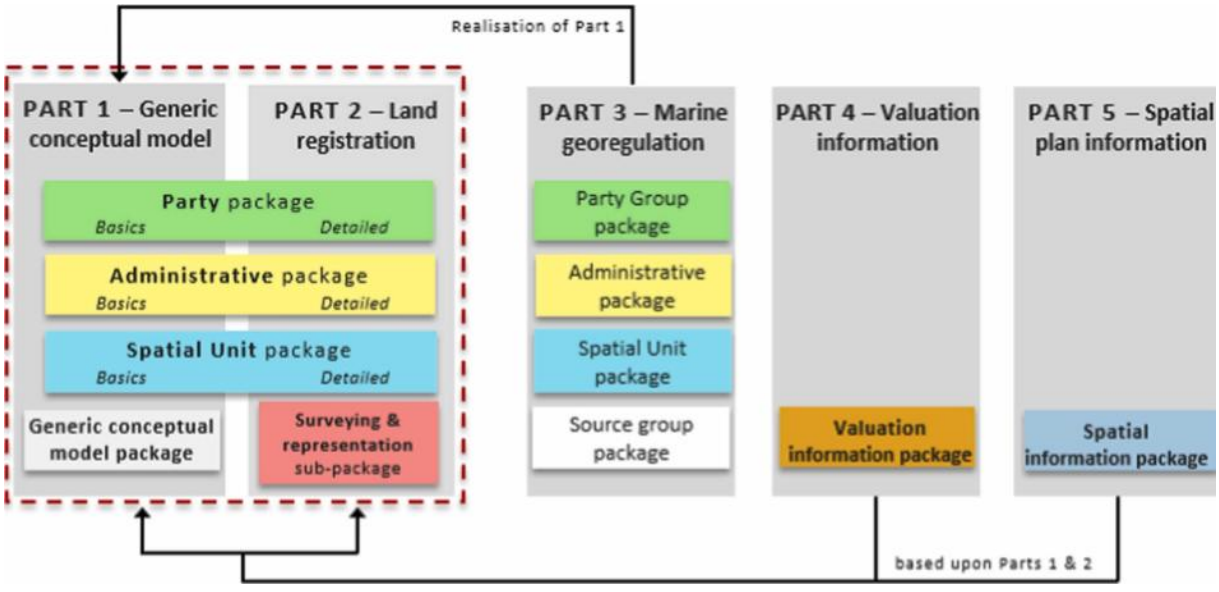

Figure 8. LADM Edition II Packages in relation to parts. Source: Kara et al. (2024a)

4. INTEGRATION AND INTEROPERABILITY

The extended LADM is based on six basic classes, all inheriting from VersionedObject (and associated to LA_ Source). The first four core classes (LA Party, LA_RRR, LA_BAUnit, and LA_SpatialUnit) have been described in the ISO 19152:2012. The two new classes are: 1) Class VM_ValuationUnit, and: 2) Class SP_PlanUnit. Figure 9 shows the basic classes of the LADM Edition II.

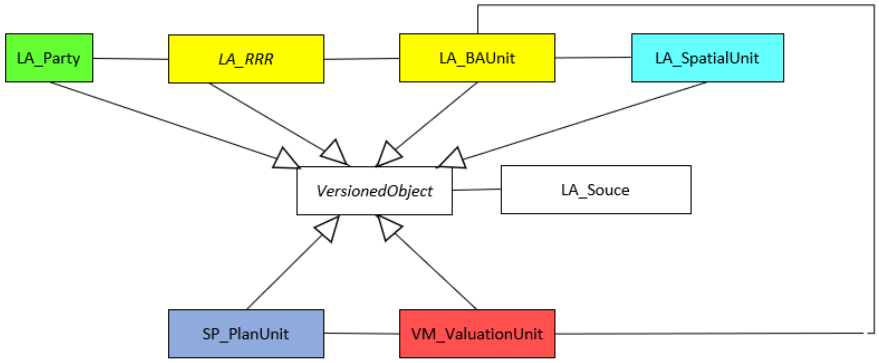

Figure 9. six basic classes in LADM Edition II

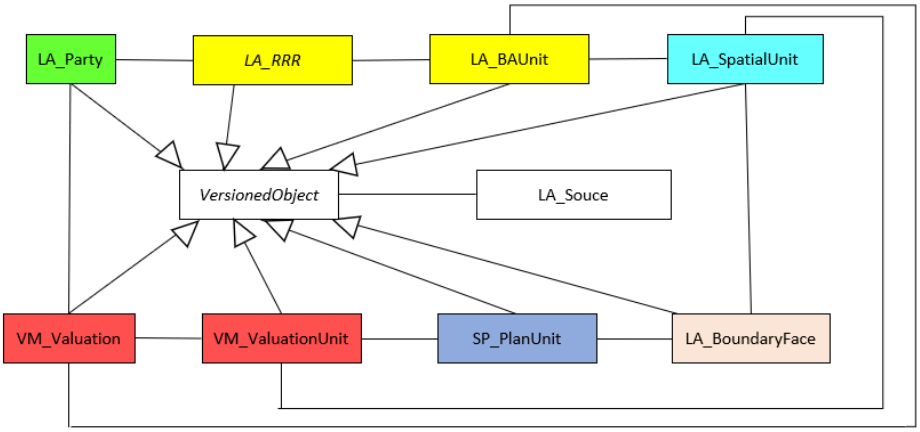

Figure 10. Number of base classes extended, all packages represented

Figure 10 shows an extension of Figure 9 with classes from all packages included and more relationships (associations). The associations between the new valuation information package and the existing packages from Edition I are organised via LA_Party and LA_SpatialUnit. The new Spatial Plan Information Package is linked with original packages from Edition I via spatial relations where LA_BoundayFace is for 3D (included) and LA_BoundaryFaceString is for 2D (not included).

A central strength of LADM lies in its ability to integrate diverse land administration functions and ensure interoperability across institutional domains. As illustrated in Figure 11, the revised LADM Edition II is structured into packages that reflect the major registries and administrative processes: population and business registers, land registry, cadastre, valuation registry, surveying, and spatial planning. These packages are conceptually distinct but linked through well-defined associations, enabling distributed yet coordinated data management.

For example: entities in the Population and Business Register (such as LA_Party and LA_GroupParty) connect to the Land Registry (LA_RRR, LA_Right, LA_Restriction, LA_Responsibility, LA_Mortgage) to represent the relationships between people and land. The cadastre register supports detailed spatial representation through classes such as LA_SpatialUnit, LA_Level, and LA_LegalSpaceBuildingUnit, which are directly associated with survey observations (LA_Point, LA_BoundaryFaceString, LA_BoundaryFace and LA_SpatialSource) from the Surveying register. Similarly, the Valuation Register (VM_Valuation, VM_Building, VM_CondominiumUnit) is integrated with spatial units and transaction information, ensuring that valuation data is consistently tied to cadastre and land register records.

The Spatial Planning register (SP_Plan, SP_Permit, SP_PlanUnit) links planned land use to existing legal and spatial structures, providing coherence between present rights and future development scenarios.

LADM enables interoperability at conceptual level (as foundation for technical level/ encodings). Technical interoperability is achieved by providing standardised UML models that can be implemented directly in databases, GIS systems and software applications. Syntactic interoperability is achieved by defining uniform data structures that different systems can exchange without loss of meaning.

Semantic interoperability is facilitated by a shared vocabulary and conceptual alignment, ensuring that terms such as ‘spatial unit’, ‘right’, ‘valuation’ and ‘spatial plan’ have the same meaning in the land administration systems. Finally, institutional interoperability is supported by relationships, enabling coordination based on a common framework.

Interoperability in land administration reduces data duplication, improves information consistency and fosters trust among institutions and stakeholders. In distributed environments, each authority maintains its own databases and responsibilities, but LADM ensures semantic consistency and seamless information flow between them. This enhances governance and transparency, and supports modern applications such as 3D cadasters, marine space management, participatory planning and automated valuation models.

Ultimately, the interoperability enabled by LADM provides a foundation for integrated land administration ecosystems that can adapt to evolving societal, legal and technological needs. See Figure 12.

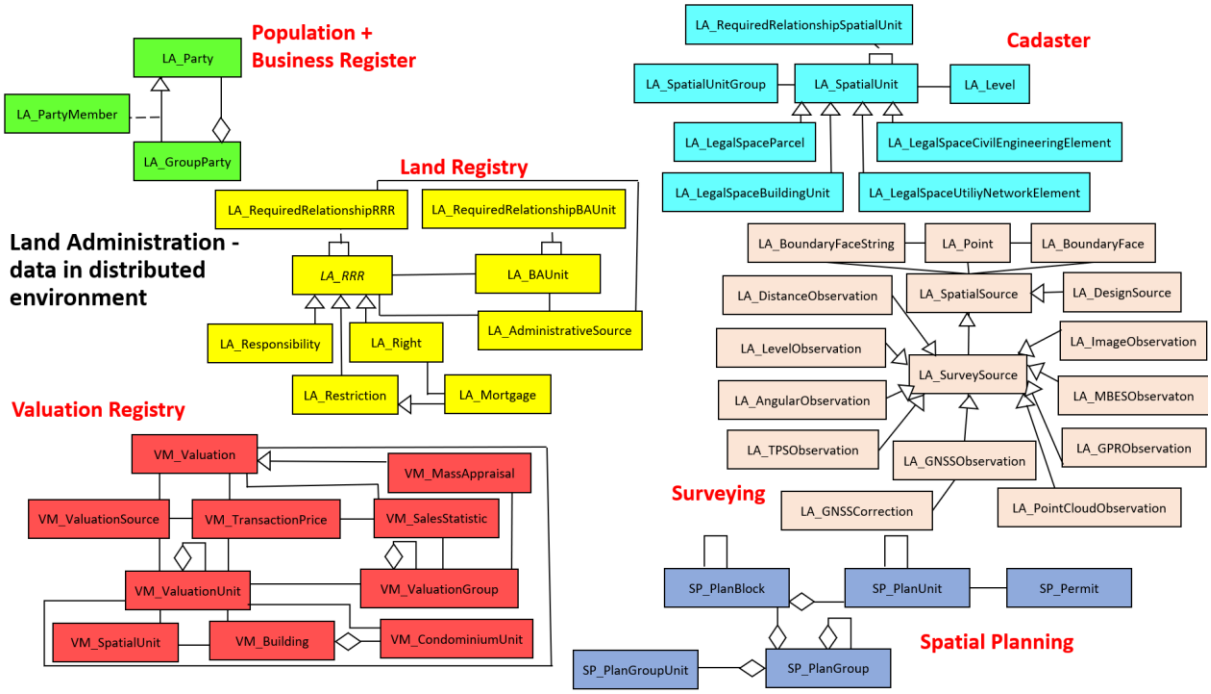

Figure 11. Land Administration in a distributed environment

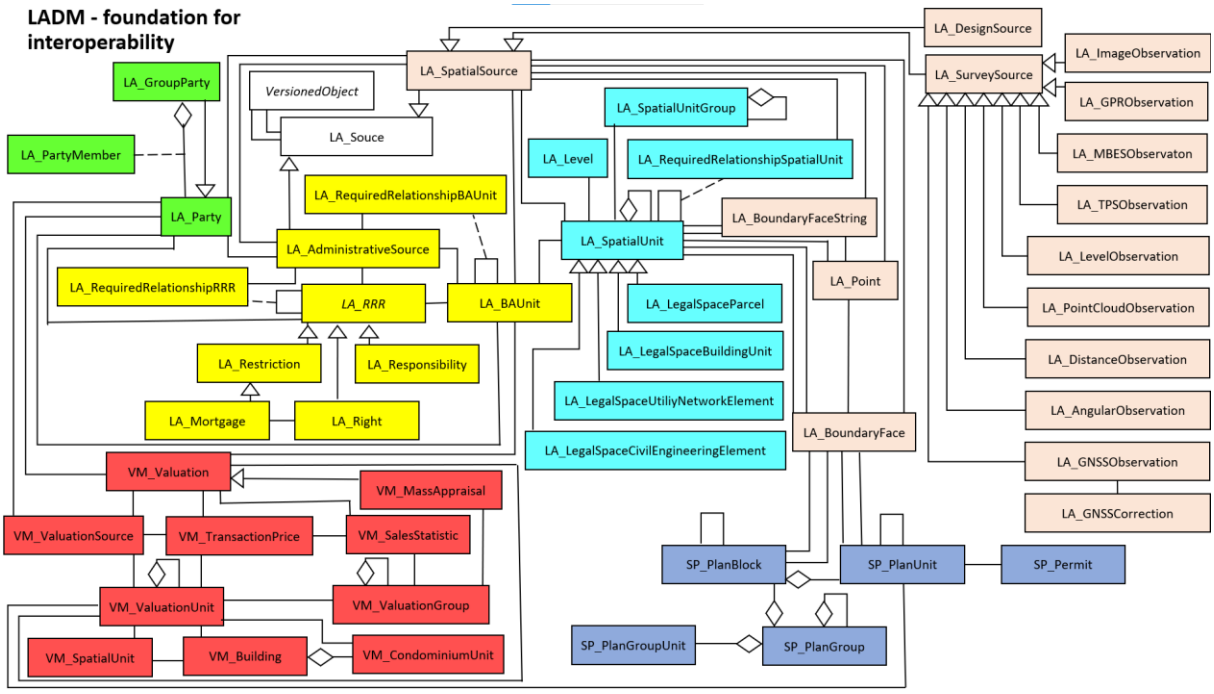

Figure 12. LADM as foundation for interoperability

5. CHANGES IN EDITION II COMPARED TO EDITION I

Part 1 (ISO 19152-1:2024) of the new edition of LADM defines fundamental terms, basic components and relationships related to land administration/georegulation objects. Part 2 (ISO 19152-2:2024) presents the basic components, relationships, attributes and constraints for land registration. A detailed overview of the model has been presented in its individual packages.
A general overview of the model is presented in its individual packages, and a more detailed overview of the LA_Source and VersionedObject classes has been included in Part1.
Two new classes are: 1) Class VM_ValuationUnit, and: 2) Class SP_PlanUnit.
The terms, although unchanged in principle, have been defined more rigorously in Part 1 (i.e. basic administrative unit, land, party, right, restriction, responsibility, source, spatial unit), enriched with examples and notes, and new terms have been introduced, such as "georegulation", "regulation" and "fraction". Updates in other ISO/TC 211 documents (i.e. definitions, data types) have been reflected, and corresponding adjustments have been made where necessary.
With the association relationships between VersionedObject and LA_Source, instances of sources have now been versioned, in contrast to ISO 19152:2012. Constraints have been introduced in Part1 for the relationships to ensure that dates and times in VersionedObject and LA_Source correspond. In addition, VersionedObject and LA_Source have a second set of optional temporal attributes (beginRealWorldLifespanVersion, endRealWorldLifespanVersion, and acceptance) representing the corresponding valid times in the real world. The bi-temporal model with intervals for both system and real-world time is now supported with the addition of temporal attributes to VersionedObject. The multiplicity of the beginLifespanVersion attribute has been changed from mandatory [1] to optional [0..1] and the initial value for this attribute has been set to "realWorldTime". The initial value of availabilityStatus attribute of LA_Source has been set to "documentAvailable". Requirements to which a land administration/georegulation system can conform have been formulated. Generic definitions for code list values have been provided.
An overview of all parts in the ISO 19152 series is provided in ISO 19152-1:2024. The bibliography for Part 1 and Part 2 has been revised to include additional references and has been reformatted.
In Part 2 administrative source, liminal spatial unit have been enriched with examples and notes. Updates in other ISO/TC 211 documents (i.e. definitions, data types) have been reflected, and corresponding adjustments have been made where necessary.
Part 2 introduces 13 new (featureType) classes (LA_SurveySource, LA_DesignSource, LA_SurveyRelation, LA_DistanceObservation, LA_LevelObservation, LA_AngularObservation, LA_ ImageObservation, LA_TPSObservation, LA_PointCloudObservation, LA_GNSSObservation, LA_ GNSSCorrection, LA_GPRObservation, LA_MBESObservation), which are different from ISO 19152:2012. These new classes also include specific attributes. In addition, the attributes of the 3 new (featureType) classes of ISO 19152-1 (LA_RequiredRelationshipRRR, LA_LegalSpaceCivilEngineeringElement, LA_ LegalSpaceParcel) have been introduced into this Part 2. Further, in order to support all types of spatial units, two new subclasses for LA_SpatialUnit have been introduced: LA_LegalSpaceCivilEngineeringElement and LA_LegalSpaceParcel. An optional geometry attribute has been added to LA_SpatialUnit. And the LA_LegalSpaceUtilityNetwork (featureType) class has been renamed to LA_

LegalSpaceUtilityNetworkElement. The LA_UtilityNetworkType code list has been renamed to LA_ UtilityNetworkElementType.
No (featureType) classes originally specified in ISO 19152:2012 have been removed.
The surveying and representation sub-packages have been refined in Part 2 with types of observation information, such as distance, level, angular, image, terrestrial positioning system (TPS), point cloud, global navigation satellite system (GNSS) and ground-penetrating radar (GPR).
In order to represent topological relationships between spatial units, two new (dataType) classes (i.e. TopoRelation and IntersectionPatternMatrix) have been created and introduced in Part2, based on the definition given in ISO 19107. In addition, 3 code lists (i.e. TopoRelationType, DimensionExtension and SetMask) have been introduced based on the definition given in ISO 19107.
The optional attributes human sex, signature, fingerprint, photo and civil status have been added to LA_Party in Part 2. One multiplicity of an association has been changed so that a point can now be associated with more than one spatial unit.
The former Annex I (from ISO 19152:2012, informative), *'Social Tenure Domain Model',* has been refined and repositioned as Annex B (normative) in Part 2. The former Annex A (a normativeAnnex), *'Abstract test suite',* has been redesigned in Part 2 in accordance with the requirements of the main body of this Part 2. A new Annex K (informative) *'LADM and indoor GML'* and Annex L, *'LADM and 3D legal spaces in buildings'* have been introduced in Part 2. The former Annex H, *'The LADM and LPIS',* and Annex N *'History and dynamic aspects'* from ISO 19152:2012 have been deleted.
All other annexes not mentioned have been updated and refined. Annex C, *'2D and 3D representations of spatial units',* has been refined and extended to support all types of spatial unit representation. AnnexG, *'Code lists'* has been refined and extended to support semantically enriched code list values. Generic definitions for code list values have been provided. Existing code lists have been refined with new values, and 24 new code lists have been introduced (i.e. LA_CivilEngineeringType, LA_ParcelUseType, LA_SurveyPurposeType, LA_AutomationLevelType, LA_PlatformType, LA_SurveyMethodType, LA_ObservationsAccuracyType, LA_LifecyclePhaseType, LA_DesignFileCreatorRoleType, LA_ DesignObjectType, LA_SourceFileType, LA_SpatialTransactionType, LA_DistanceType, LA_ AngleType, LA_SatelliteSystemType, LA_GNSSSurveyType, LA_GNSSReferenceStationsNetworkType, LA_GNSSReferenceStationsNetworkScale, LA_CorrectionServiceType, LA_GNSSFrequencyType, LA_ SSR_Error_Components, TopoRelationType, DimensionExtension and SetMask).

6. DISCUSSION

This paper presents the conceptual foundation and practical relevance of the revised LADM. It outlines how the model enables a common language between land administration professionals and information technology experts, supporting system design, data integration, and interoperability across diverse organizational contexts. Finally, the paper discusses integration and interoperability aspects and situates the new ISO standards within ongoing international developments, including recent publications from the International Federation of Surveyors (FIG).

Together, these five parts significantly enhance the usability and relevance of the LADM standard across a broad spectrum of applications, from cadastral data management and urban planning to property valuation and marine cadastre. They provide a foundation for the development of digital land administration ecosystems, improve the quality and comparability of land-related data, and support international efforts to achieve Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 11 (Sustainable Cities and Communities), and SDG 15 (Life on Land). The modularization of the standard also allows countries and organizations to implement the parts, depending on their specific needs and capacities, while still ensuring semantic consistency.
The publication of the first five parts of LADM Edition II represents not only technical advancement but also a strategic opportunity for countries to modernize their land administration infrastructure in alignment with international best practices. It opens new pathways for integration between cadastral, marine, valuation, and spatial plan systems, thereby improving land governance, reducing disputes, and enabling data-driven policy development. As LADM continues to evolve—with additional parts under development and ongoing discussions on implementation (with key role for OGC), the newly released ISO standards set a robust framework for innovation, collaboration, and capacity building in land administration worldwide.
Standards provide many benefits, such as enabling interoperability, cost effective (as solution can be reused after possible local adaptation), and reusing the knowledge of a global community. Standards documents are often quite difficult to understand due to the rather high abstract level and formal language. Therefore, the LADM edition II series also contains several annexes, providing examples in the form of instance level diagrams (cases), country profiles (showing how LADM can be applied in the specific setting of a country), mappings to the corresponding European INSPIRE models, and much more. Further, FIG and ISO have produced a LADM overview for managers (FIG publication no. 84) and a textbook LADM in de classroom. All these efforts have resulted in rapidly growing adaption of LADM (e.g. more than 50 country profiles published) and STDM (Social Tenure Domain Model, a specialisation of LADM for developing countries) has been applied 17 countries by UN-HABITAT.
For new LADM applications a comprehensive set of references to existing developments (see Kalogianni (2021) based on this International ISO Standard. More and more experts with experience in real applications of LADM are available. And LADM is well recieved in the standardiastion community, see Annex 1.
A new part of LADM Edition II entitled *'Implementation' is* under development.

7. FIG PUBLICATIONS ON LADM (TBD)

A new publication has recently appeared in the International Federation for Surveyors publication series. It is entitled 'The Land Administration Domain Model - An Overview', see Lemmen et al. (2025a). This publication seeks to give a summarised view of the background, but, also introduction to LADM for a larger audience, especially management.

An extended version of the publication, titled "LADM in the Classroom", focuses on training and higher education. It is a valuable resource for those who want to learn, know, understand, apply or share experiences with LADM (Lemmen, 2025b).

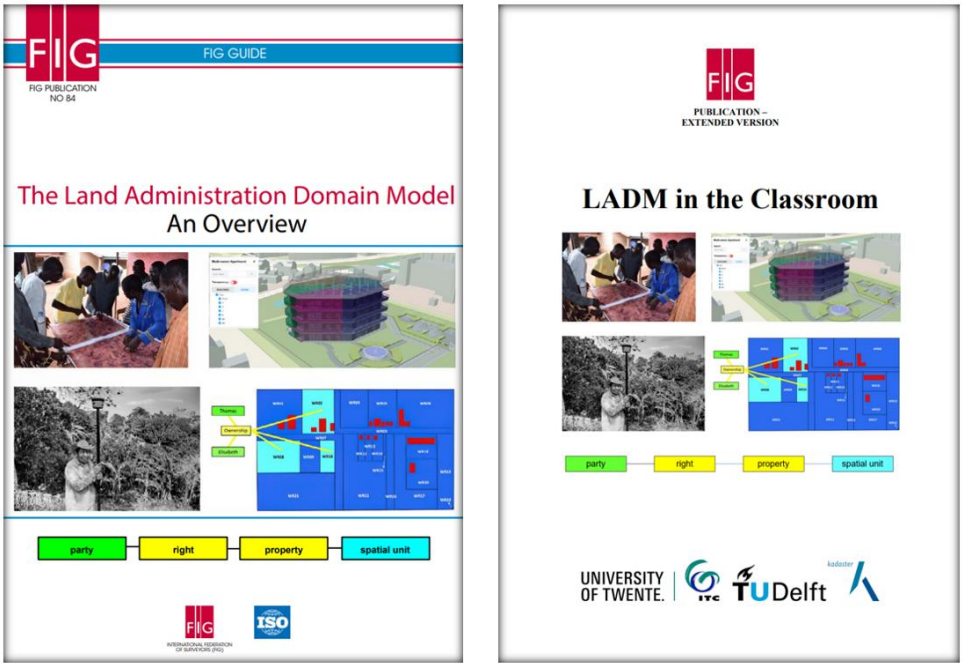

Figure 13. Two FIG Publications on LADM

Lecture slides and case-based learning materials are also available related to 'LADM in the Classroom', see Da Silva Mano, A. (2024) and the following site:

https://github.com/andremano/ladm_classroom/tree/1.3

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ISO 19152-2:2025 Geographic information – Land Administration Domain Model (LADM) – Part 2: Land registration

ISO 19152-3:2024 Geographic information – Land Administration Domain Model (LADM) – Part 3: Marine georegulation

ISO 19152-4:2025 Geographic information – Land Administration Domain Model (LADM) – Part 4: Valuation information

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BIOGRAPHICAL NOTES

Peter van Oosterom obtained a PhD from Leiden University in 1990. He is professor at Delft University of Technology, head of the 'GIS Technology' Section of the Faculty of Architecture and the Built Environment He is current chair of the FIG Working Group on '3D Cadasters'. He is co-editor of the ISO Land Administration Domain Model (ISO 19152), a global standard on land administration.

Abdullah Kara holds a PhD (2021) from Yıldız Technical University on extending the Land Administration Domain Model (LADM) with valuation information, forming the basis for LADM Part 4. He has worked as a researcher at Delft University of Technology and, since 2024, as an assistant professor at Gebze Technical University. He is actively involved in FIG working groups.

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ANNEX 1

Outcome of the LADM Edition II Ballots:

- NWIP concerns the New Working Item Proposal (as submitted by FIG to ISO/ TC211 on Geographic Information
- CD is the so called Committee Draft as provided by the TC211. The procedure for this CD changed during the LADM development, for this reason the results can only be provide for Part.
- DIS is the Draft International Standard
- FDIS is the Final Draft International Standard

See the Table below for the results.

	NWIP			CD			DIS			FDIS		
	Yes	No	Abstain	Yes	No	Abstain	Yes	No	Abstain	Yes	No	Abstain
19152-1	19	0	17	21	1	15	22	1	12	25	1	12
19152-2	20	0	16				22	1	15	28	1	13
19152-3	17	0	17				22	0	17	23	1	17
19152-4	21	0	14				19	1	21	27	1	16
19152-5	19	1	15				28	1	13	27	1	16