LADM COL
Land Administration Domain Model

Vol. 7:

Characterization of the Current Variables of the Extended Model Cadastre-Registration LADM-COL version 4.0

IGAC
INSTITUTO GEOGRÁFICO
AGUSTÍN CODAZZI

Dirección de
INVESTIGACIÓN
y prospectiva

Land Administration Domain Model - Colombia Volume 7

Characterization of the Current Variables of the Extended Model Cadastre-Registration LADM-COL version 4.0

IGAC
INSTITUTO GEOGRÁFICO
AGUSTÍN CODAZZI

Dirección de
INVESTIGACIÓN
y prospectiva

Agustin Codazzi Geographic Institute
Research and Prospective Directorate

Johan Andrés Avendaño Arias
Technical Director, Research and Prospective Directorate

Diego Fernando Sánchez
Elkin Dario Pérez
Erick Nicolas Sarmiento Linares
Héctor Andres Castro
Ivan Daniel Torres Beltrán
Juan Carlos Ramírez Caicedo
Mónica Vanessa Paternina Riaño
Paola Vanesa Navarrete Prada
Sebastián Sierra Bernal
Sebastián David García Guzmán
Researchers

Oswaldo Ibarra
Alexander Páez
Content Review

Gloria Yulier Cadena-Montero
Managing Editor

Angela Marcela Ortiz
Sofia Alejandra Estrada Cely
Gian López
Translation

Sofia Alejandra Estrada Cely
Angela Marcela Ortiz
Copy Editing

Gabriela Amaya Vásquez
Jose Castro Garnica
Sofia Alejandra Estrada Cely
Design and Layout

Table of contents

Tables

Table of Figures

Preliminary Considerations

The Instituto Geográfico Agustín Codazzi (Agustin Codazzi Geographic Institute —IGAC by its acronym in Spanish—), in its exercise as the maximum cadastral authority, gives the following linear and progressive documents, with the present one being the first. These documents are the result of a research process emphasized in bibliographical review and the generation of documents that could be used as input for the comprehension, development, and promotion of the Land Administration Domain Model (LADM) and the adoption of this one to the Colombian profile, denominated as LADM-COL.

Throughout the document review, it will be possible to encounter diverse technical and methodological analyses of the process, history, changes, and behavior that the LADM-COL Extended Model Cadastral-Registration, and the various application models that surged in the framework of Multipurpose Cadastre, thus seeking to make the cadastral approach the center of these writings so that the various actors of the cadastre and the community in general have within reach a purified and synthetic version of the processes, lessons and current state of the adoption of the models, based on official documentation from the IGAC as the governing body.

Regarding the documentation of these models, it has been observed that if the official information, issued by different national organizations, is contrasted over time, since the conception of the standard's inclusion in Colombia, it may present some ambiguities or appear to be inconsistent in terms of the terminology associated with designated them and the competencies related to them. This corresponds to the institutional development, evolution, and understanding of the implementation of the Land Administration Model in Colombia, oriented towards cadastral management with a multipurpose emphasis.

In the ensuing part is a conceptual map displaying the name of each document, a brief description, and the position that it occupies within the sequence, to delimit its scope and provide the reader with a general overview that allows them to navigate its contents more easily (Figure 1).
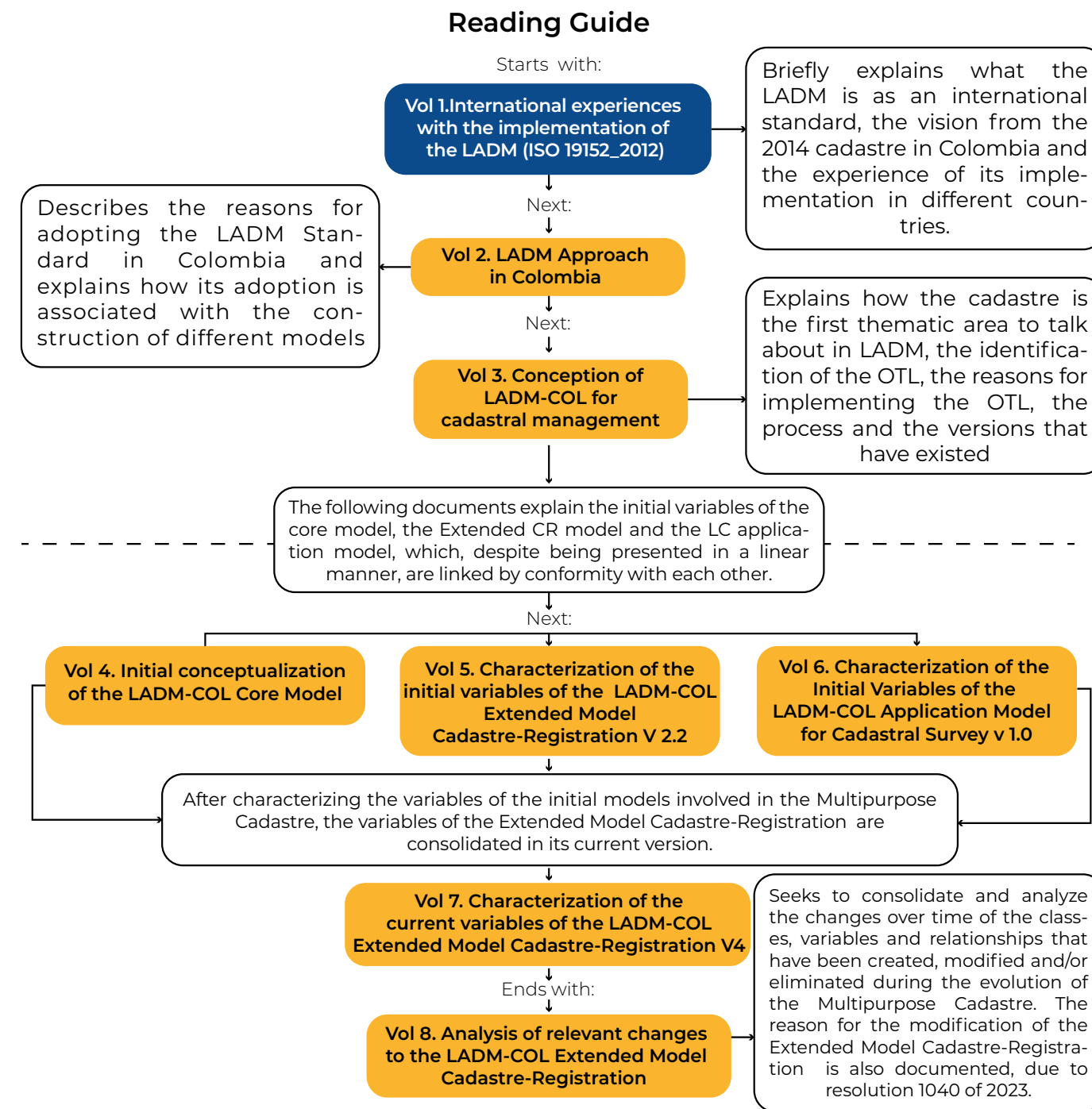

Figure 1. Reading guide for Documents Related to LADM Conceptualization in Colombia..
Fuente: elaboración propia.

Introduction

As part of the implementation process of the LADM_COL model, it is necessary to recognize the correct structuring procedure, for this reason, the LADM team, which belongs to the Research and Prospective Directorate (DIP), has made available this document, making the process of implementing this data structure known.

This will allow users to become familiar with each component of the LADM_COL model and, in turn, will facilitate the relationship of similar concepts in the extension and application models, in particular, in the case of the Extended Model Cadastre-Registry (MECR).

Like any process, this contains a series of steps that derive from the analysis and creation of relationships to generate a class diagram, which has a specific color code based on the core model. Thus, the structure of the classes will be displayed along with their respective division and package descriptions.

The mentioned diagram is the basic input for creating a database, which is why a basic knowledge of these tools is required for managing properly the information provided.

With the knowledge and review of these structures, it is considered that the user (person, entity, or cadastral manager) will be able to subtract the corresponding information and create even more specific and adaptable information to the study or work model that is being carried out, corresponding to the context where not only LADM_COL model could be used, but also its extended models, and even the application model created.

All of this is part of the strategy and approach of the land administration system so that each entity, person, or cadastral manager has better conceptual bases to carry out their work and contribute to better data structuring in the framework of the multipurpose cadastre approach.

Core Model in the MERC

To characterize the initial variables of the MECR in its version 4.0, it is estimated that, since it is an "extended" model, it is necessary to differentiate what part of such extension corresponds to the core model. This will allow a better understanding of the elements incorporated for description, such as a data model, or the cadastral and register information for land administration.

Figure 2 illustrates the MECR UML Diagram, where the core model (LADM-COL) classes are enclosed with a dotted line, so the classes that extend outside of this are the non-common, specialized, and thematic, which constitute the MECR.
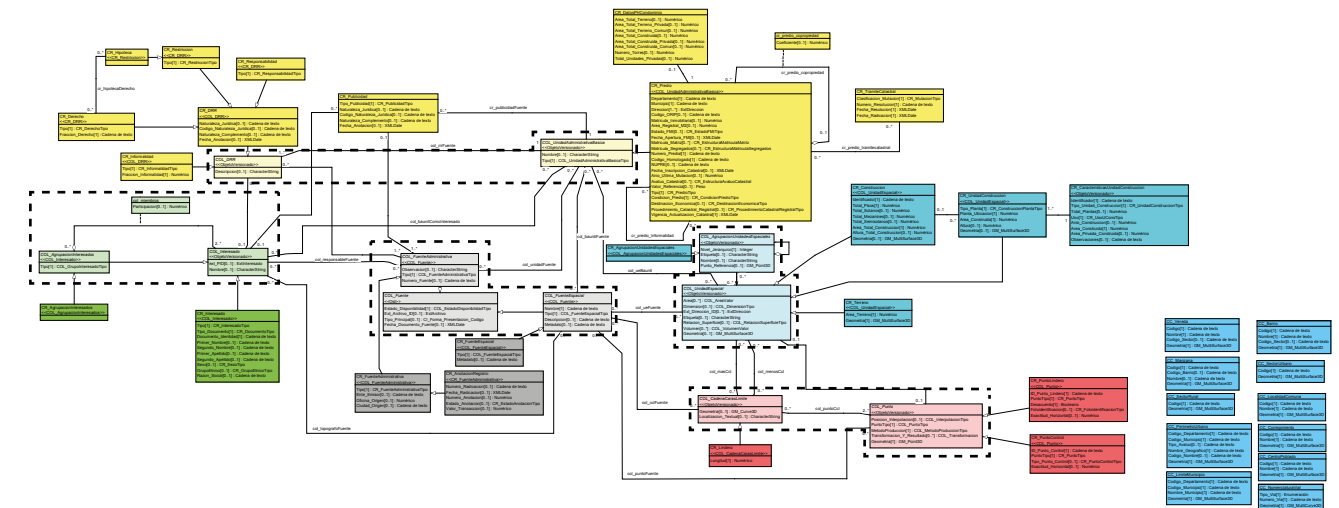

Figura 2. Differentiation of the Core Model in the MECR version 4.0
Source: adapted from IGAC (2023).

In general, Figure 2 shows the color convention of the core model, as stated below:
- In yellow is the Administrative Package, which contains the basic administrative unit, as well as the type of rights, restrictions, and responsibilities, in addition to others that can be consulted in this document.
- In green is the Party Package, which includes those individuals with rights, restrictions, and responsibilities over the properties, especially within the cadastral context.
- In gray is the Document Package which covers the evidence associated with the other classes or relationships of the model They become the information backup.
- In blue is the Spatial Unit Package, which is directly related to all the elements of the basic administrative units.
- The Surveying and Representation Subpackage is represented in red. It contains the classes associated with geographical objects, which also allows the properties to be located and spatially identified.

Finally, to clarify the multiple subsequent versions, throughout the reading of this document, that will also describe its parts, it must be taken into account that all the core model classes without exception carry the prefix COL.

Current MERC Variables Version 4.0

Below, to check the current MERC variables, a package-by-package verification of the model will be carried out (see Appendix C).

Administrative Package

Regarding the Administrative Package, it is important to remember that it is based on a main class of the COL_DRR core model as well as the basic administrative unit, which will be detailed below:

Basic Administrative Unit.

As mentioned in the introduction, the core model is complemented by different land administration elements and revolves around the basic administrative unit, which in the case of Cadastre-Register is Predio (property in English; Figure 3).
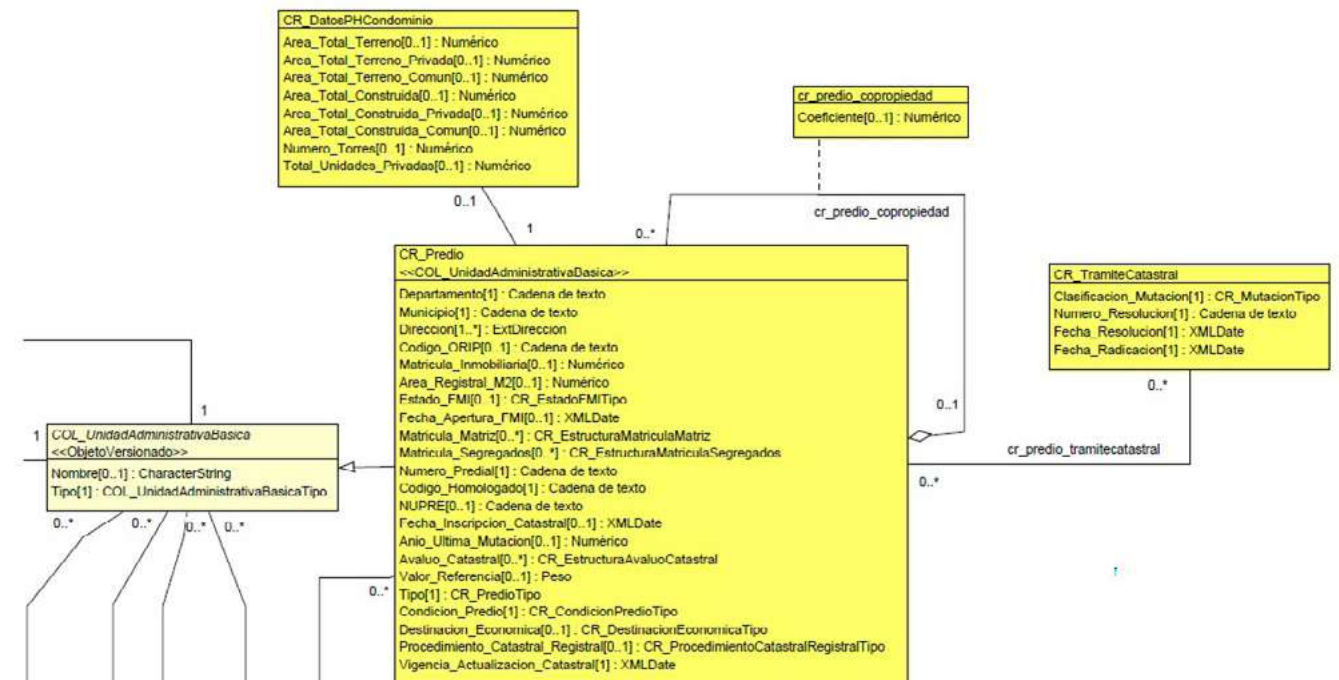

Figure 3. Predio MECR Administrative Package and Basic Administrative Unit Version 4.0.
Source: IGAC (2023)

The classes that form the Administrative Package are detailed in Table 1.

Table 1. Classes, Aliases, and Description of the Administrative Package

Class	Alias	Description
CR_Predio	(CR) Predio	BaUnit specialized class, which describes the basic administrative unit in the Colombian case. The property is the legal territorial unit of the cadastre. It is formed by the terrain and it may or may not have associated buildings. To complete the Property ID attribute, the latest guidelines given by the IGAC must be followed.
CR_DatosPHCondominio	(CR) Datos PH Condominio	The class that contains the main data of the parent property included in the horizontal property regime.
CR_TramiteCatastral	(CR) Tramite catastral	Class that contains the changes that occur in the physical, legal, or economic components of a property, once they have been formed.
CR_predio_copropiedad	-	Relationship between property units and parent properties under the horizontal property and condominium regime.
CR_Publicidad	(CR) Publicidad	
COL_UnidadAdministrativaBasica	-	Generically, it represents the legal land object (Cadastre, 2014) that is managed in the model, in this case, the cadastral plot or property. It is independent of the knowledge of its spatial reality and focuses on its known and recognized existence.

Additionally, the CR_Publicidad class reports the ongoing administrative processes that a property may have (Figure 4).

Figura 4. CR_Publicidad Class of the MECR Administrative Package Version 4.0. **Source:** IGAC (2023)

Likewise, within the LADM-COL Extended Model Cadastre-Registry, the Rights, Restrictions, and Responsibilities.

Figure 5. Domains of the MECR Administrative Package Version 4.0.
Source: IGAC (2023)

Rights, Restrictions, and Responsibilities.

The rights, restrictions, and/or responsibilities are the basis of the relationship between the parties and the basic administrative unit. Public deeds are a clear example in which the party has the right to a property and, therefore, is supported by this document.

Responsibilities related to the property refer to the legal or administrative obligations that the owner(s) of the property have. Likewise, the rights are all those legal powers that parties have over the basic administrative unit, while the restrictions are the obligations imposed on those who hold rights to the land.

COL_DRR works as an abstract class and is instanced from the class CR_DRR, from which the classes CR_Derecho, CR_Restriccion, and CR_Responsabilidad are derived, which is why COL_DRR requires that the data relates to a restriction, a right and/or a responsibility. In addition, informality is also diagrammed in the model as an inhered class of COL_DRR since this condition can lead to a right, restriction, and/or responsibility and must be taken into account within the characterization process of the basic administrative unit (Figure 6).
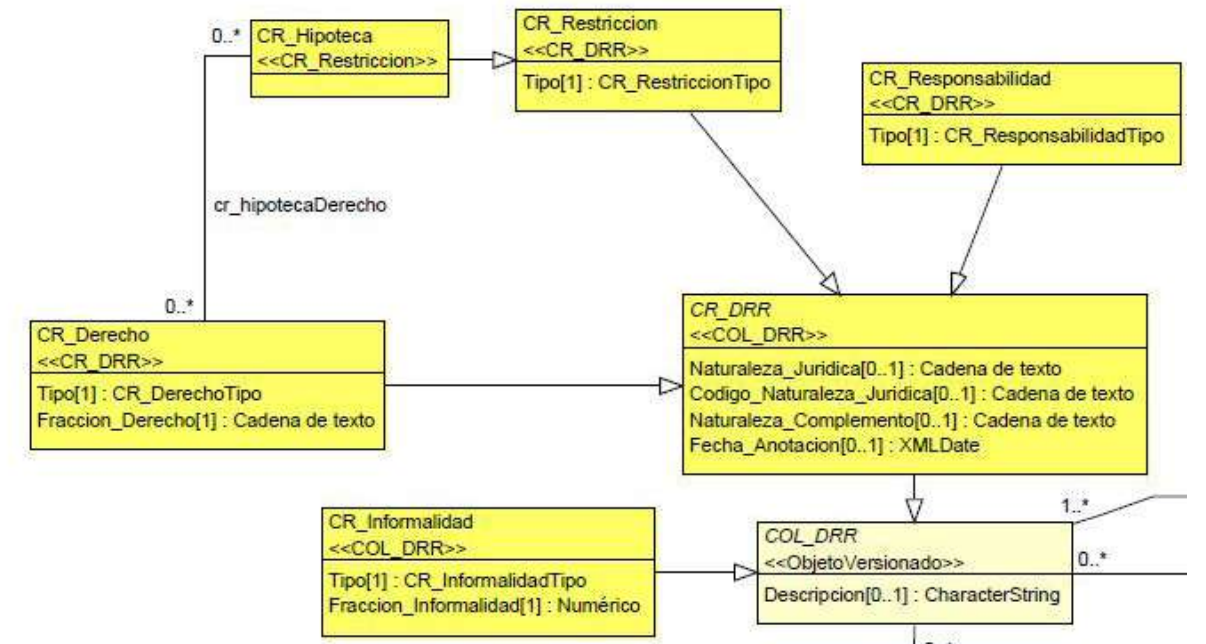

Figure 6. Administrative Package Rights, Restrictions, Responsibilities in the MECR Version 4.0. **Source:** IGAC (2023)

Party Package

In the case of the Party Package (Figure 7), the majority of the classes belong to the core model. The COL_Interesado class is abstract, which means it only instances through its inhered classes. A party could be a single person, whether natural or legal or any number of parties, forming together a distinct entity, with each party registered.
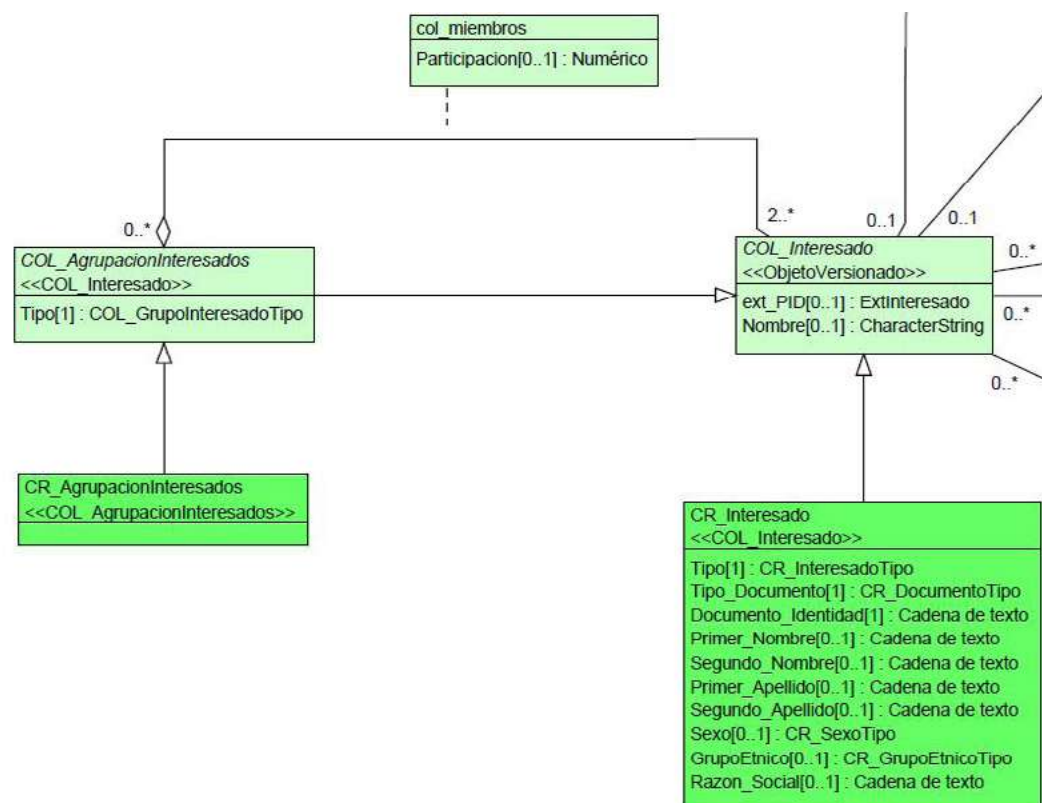

Figure 7. MECR Party Packages Version 4.0. **Source:** IGAC (2023)

One of the inhered classes is COL_AgrupacionInteresados which comes from the core model and refers to those cases where there may be more than one interested party organized in a civil, business, ethnic, or mixed group, also called Group Party. There is also the COL_Miembros class where the group members are connected with their different or equal participation percentages.

Regarding the classes that are part of the MERC itself, the class CR_AgrupacionInteresados becomes an abstract class that is instanced through the parent class COL_AgrupacionInteresados. Likewise, the CR_Interesado class contains the basic information of the owner, specifically if there is only one owner.

The classes that form the Party Package and their descriptions are found in Table 2.

Table 2. Classes, Aliases, and Description of the Party Package

Class	Alias	Description
Col_Miembros	-	It connects the parties of a group party through the proportion of their participation in the group.
COL_Interesado	-	Translation of the LADM class LA_Party. Represents people who exercise rights and responsibilities or suffer restrictions regarding a BAUnit
CR_Interesado	(CR) Interesado	Is the party that has a relationship with the property due to some right type, restriction, dissemination, or responsibility.
COL_AgrupacionInteresados	-	Connects parties who hold ownership, possession, or occupation of a property. The group itself and the people separately are registered.
CR_ AgrupacionInteresados	(CR) Group of Interested Parties	The class that inherits the attributes of the COL_AgrupacionInteresados class.

Furthermore, within the LADM-COL Extended Model Cadastre-Registry, the following domains are considered for the Party Package (Figure 8).

Figure 8. MECR Party Package Domains Version 4.0. **Source:** IGAC (2023)

This is why the Party Package is strictly related to the basic administrative units (properties), which can be both natural persons and legal entities that also have restrictions, rights, and/or responsibilities over the properties.

Document Package

The source is connected to the information backup that is the basis of the records, such as documents that certify the relationship between a party and a property. These documents contain details such as the responsibilities, rights, and restrictions the interested party has over the property. Such details can be

notarized documents, maps, official cartography, or other sources of geographic information that serve as a basis for recording property information (Figure 9).
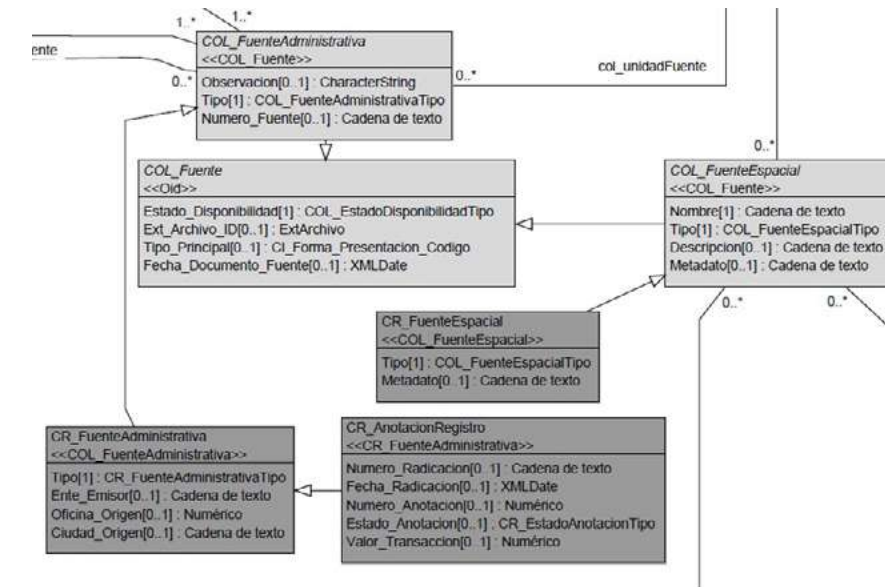

Figure 9. MECR Document Package Version 4.0. **Source:** IGAC (2023)

The Document Package contains derived classes from the core model, such as the abstract class COL_Fuente, which can be a spatial data source (inhered class COL_FuenteEspacial) or administrative source (inhered class COL_FuenteAdministrativa). At the same time, it contains classes specific to the Extended Model such as CR_FuenteEspacial, that has complementary information to the main class from the core model.

On the other hand, there is also the class CR_FuenteAdministrativa which is inhered from the core model COL_FuenteAdministrativa class, that is derived and specified in the inhered CR_AnotacionRegistro class, which refers to the different annotations that a property may have registered and its respective validity.

The classes that form the Document Package are listed in Table 3.

Table 3. Classes, Aliases, and Description of the Document Package

Class	Alias	Description
CR_AnotacionRegistro	-	It is the culmination of the registration procedure after the registration has been done and the proof of this transaction is put in the title or document subject to registration.
CR_FuenteAdministrativa	-	Class that stores the administrative sources (deeds, sentences, administrative acts, etc.) that support the right regarding the ownership relationship between the party and the property.
COL_FuenteAdministrativa	-	Specialization of the COL_Fuente class to store those sources formed of documents (mortgage documents, notarial documents, historical documents, etc.) that register the relationship between instances of parties and properties.
COL_Fuente	-	Abstract class. This class is the customization in the Colombian profile model of the LADM class LA_Source.
CR_FuenteEspacial	(CR) Fuente Espacial	Class that inherits the attributes of the COL_AgrupacionInteresados class.
COL_FuenteEspacial	-	Specialization of the COL_Fuente class to store spatial data sources (geographical entities, satellite images, photogrammetric flights, lists of coordinates, maps, old or new plans, description of locations, etc.) that document the relationship between parties and properties.

Figure 10 shows the domains related to the classes of the Document Package, where the different sources arranged in MECR 4.0 could be found.

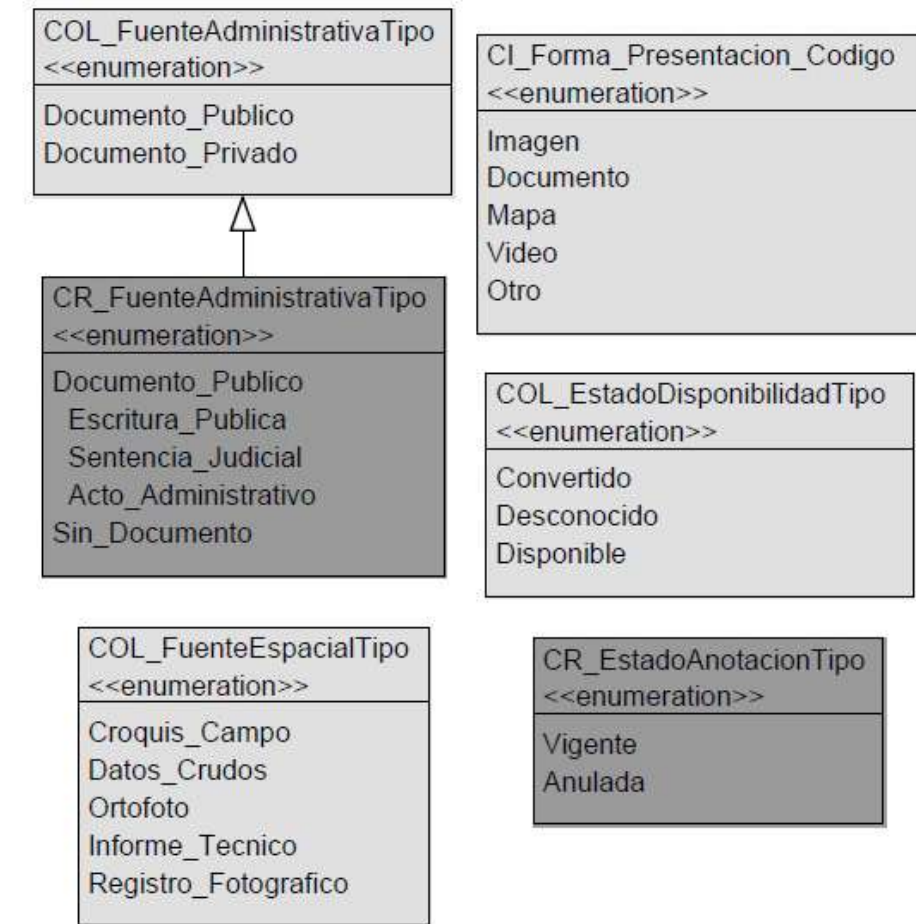**Figure 10.** MECR Document Package Domains Version 4.0. **Source:** IGAC (2023)

Spatial Unit Package

Within the MERC Spatial Unit Package, the abstract class COL_UnidadEspacial is presented, which is instanced by its different inhered classes that refer to those objects with spatial dimensions in cadastre, such as Terrenos, Construcciones, and Unidades de Construcción (Properties, Buildings, and Building Units in English).

These three objects are specialized from the parent class coming from the core model and are instanced in the classes CR_Terreno, CR_Construccion, and CR_UnidadConstruccion, which contain the information that characterizes and spatializes them, in addition to the respective geometry that defines them. Likewise, the class CR_CaracteristicasUnidadConstruccion contains all the variables that seek to itemize the building units of a property (Figure 11).
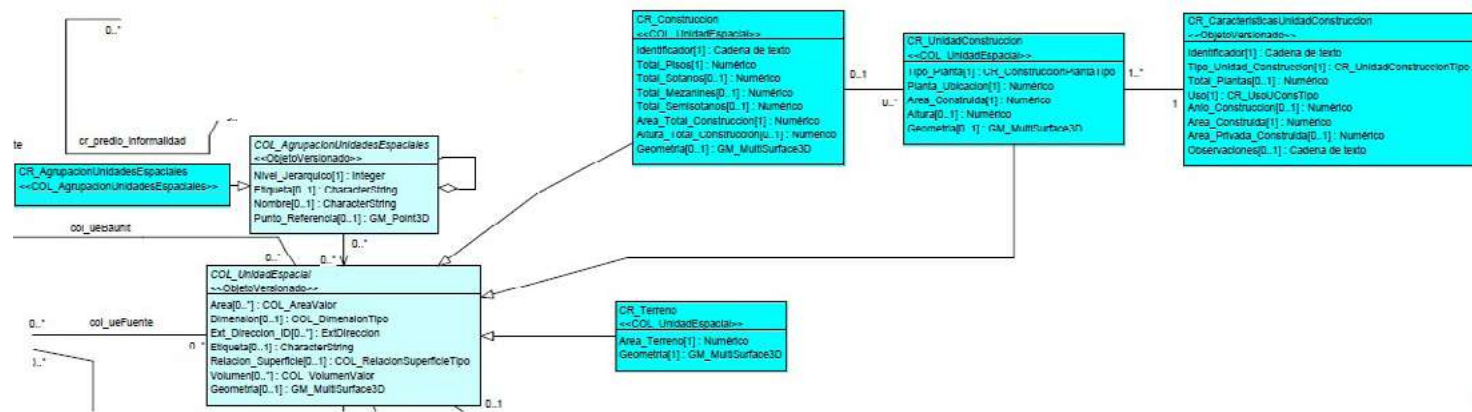

Figure 11. MECR Spatial Unit Package Version 4.0. **Source:** IGAC (2023)

The classes associated with this package are characterized by their relationship with the spatial objects representing the properties and their respective attributes (type of surface, polygon, among others), in addition to all those characteristics.

On the other hand, from the core model class COL_AgrupacionesEspaciales, which is abstract, the class CR_AgrupacionUnidadesEspaciales is derived, which was defined from the properties represented with a group spatial units, following what is defined for the parties. This is based on the fact of not having multipart geometries as this could cause discrepancies in the database. Therefore, the purpose is to group the spatial units that allow them to be associated

with similar multipart geometries that belong or are related to the property.

All the classes that form the Spatial Unit Package are described in Table 4.

Table 4. Classes, Aliases, and Description of the Spatial Unit Package

Class	Alias	Description
CR_AgrupacionUnidadesEspaciales	(CR) Agrupación Unidades Espaciales (Polygon geometry)	It groups spatial units, like geographical representations of the basic administrative units (class LA_BAUnit) to represent other spatial units that are formed based on these, as may be the case of cadastral polygons.
CR_Terreno	CR_Terreno (Polygon Geometry)	Land portion with a defined geographical extension.
CR_Construccion	(CR) Construcción (Polygon geometry)	It is a group of materials and structures built with permanent character
CR_UnidadConstruccion	(CR) Unidad de Construcción (Polygon geometry)	It is a group of materials building in a property with specific characteristics in terms of physical elements and use
CR_CaracteristicasUnidadConstruccion	(CR) Características Unidad de Construcción (Alphanumeric)	The class that allows building units to be grouped by identifier, use, and typology.

Likewise, within the LADM-COL Extended Cadastre-Registry Model, the following domains are contemplated for the Spatial Unit Package (Figure 12).

It should be considered that the Surveying and Representation Subpackage contains this prefix because it also belongs to the Spatial Unit Package, therefore, some elements may not appear in the blue classes (Figure 11), however, they are contained in the Surveying and Representation Subpackage, which will be presented below.
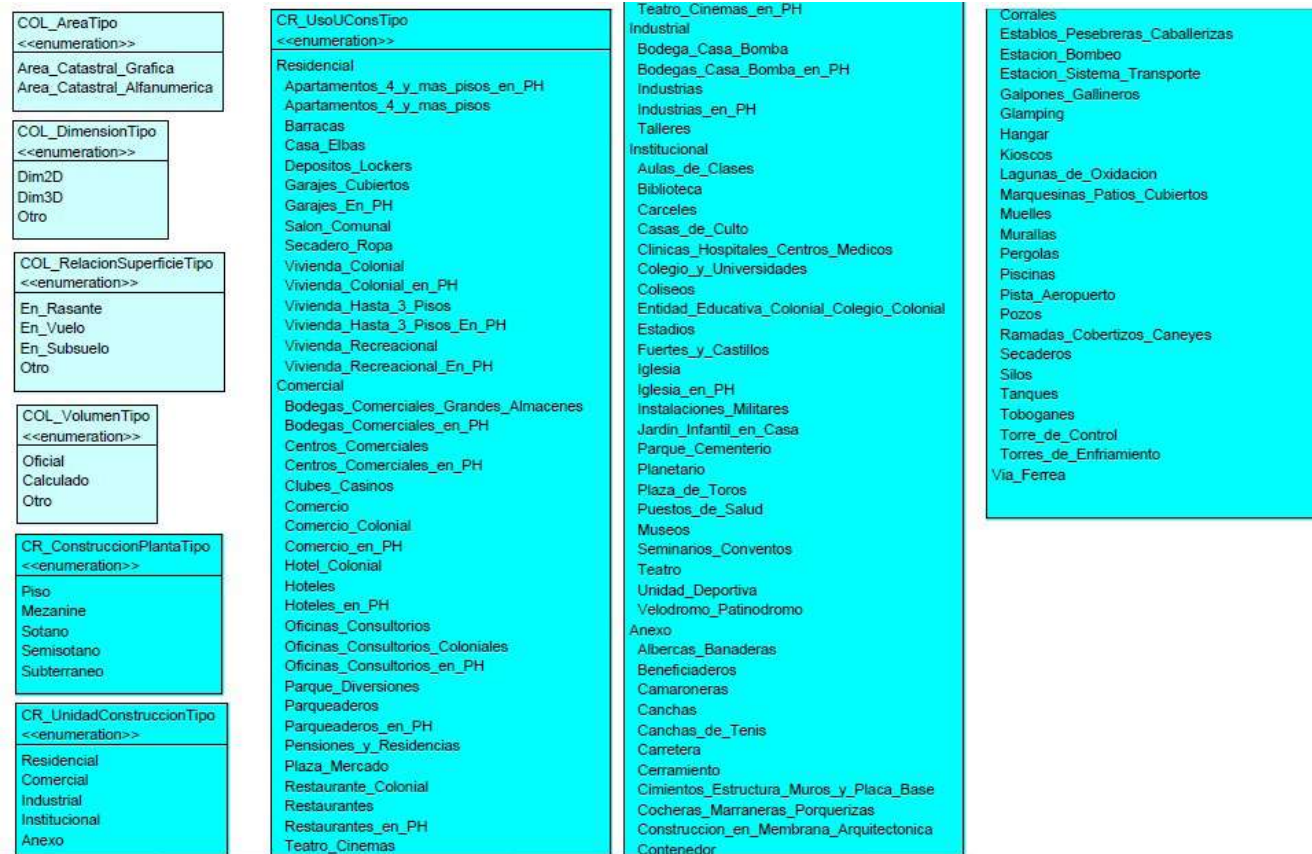
Figure 12. MECR Spatial Unit Package Domains Version 4.0. **Source:** IGAC (2023)

Surveying and Representation Subpackage.

This subpackage allows the recording of geographical information collected in the field either through topographic surveys, planimetric surveys, or georeferencing using an orthophoto. Although it is an optional requirement, it is recommended to fill out the information in the physical model, since it is the primary input for the spatial units definition. The stored data corres-

ponds to the survey points, control points, border points, and borders, as well as the associated relationships (Figure 13).lindero, linderos, así como las relaciones asociadas (Figura 13).
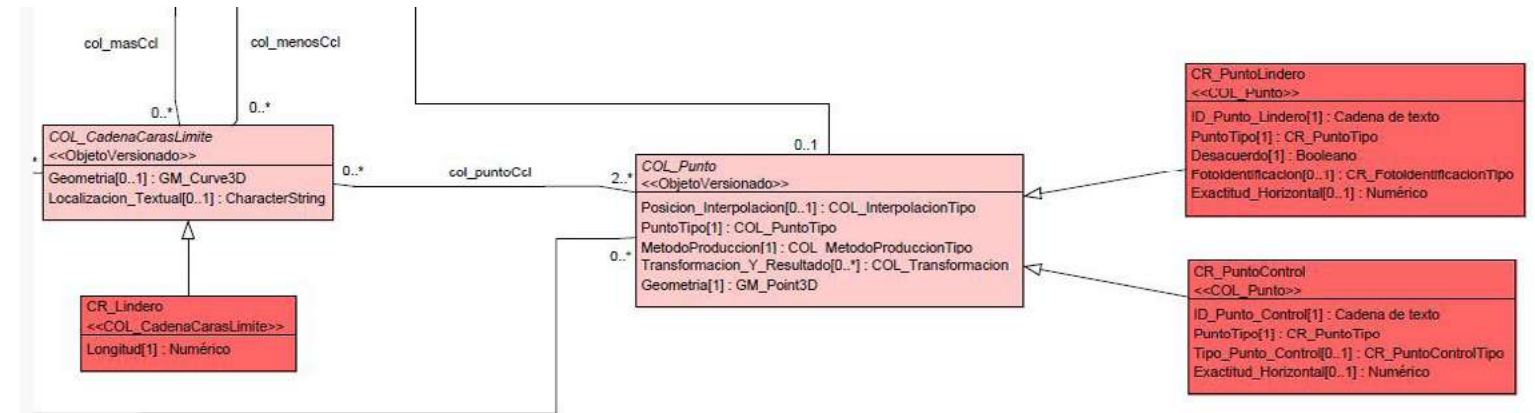

Figure 13. MECR Surveying and Representation Subpackage Version 4.0. **Source:** IGAC (2023)

Two of its classes are part of the core model: COL_CadenaCarasLimite and COL_Punto, the first one refers to the borders. This means that it represents the geographical data (vertices or lines) that form a border. The second one corresponds to the minimum unit of representation, taking into account, that a border is a line that joins two points.

Regarding the class CR_Lindero, inhered of COL_CadenCarasLimite, it is necessary to indicate that it represents the line that separates the real estate; likewise, the CR_PuntoLindero class refers to the points that form a border and the CR_PuntoControl class refers to the densification of the geodetic network or the point definition tied to the network that could be used as a reference for the identification of border points or spatial class borders of the space class, this through a control point or a local support point.

The classes that form the Surveying and Representation Subpackage are described in Table 5.

Table 5. Classes, Aliases, and Description of the Surveying and Representation Subpackage

Class	Alias	Description
CR_Lindero	(CR) Lindero	Division line that separates one real estate from another, which may or may not be physically instanced.
CR_PuntoLindero	(CR) Punto Lindero	Point that defines the border of one property with another. The succession of these points forms a line that represents the border between two pieces of land. It is assigned by the acquisition system.
CR_PuntoControl	(CR) Punto Control	Topographic or geodetic points are used as control points for the execution of the cadastral survey.

In the same way, within the LADM-COL Extended Model Cadastre-Registration, the domains shown in Figure 14 are considered for the Survey and Representation Subpackage.

This subpackage is very important, as it contains the geographical objects (points, lines) and the essential attributes to typify the property according to its location and shape, which is why it is part of the Spatial Unit Package.

Structure Tables

Finally, the presence of attributes is evident in the different classes that the packages contain, where the data is not limited to numbers, character strings, or specific domains, but rather, is an aggregation of various types of data that have the special feature of being multiple despite constituting a unit with a clearly defined structure.

For example, addresses in Colombia are determined from a structure similar to a Cartesian plane, with horizontal and vertical lines called Carrera (from north to south) and streets (from east to west). The property address depends on the main road (street or Carrera or its derivatives such as diagonals and transversals), the closest generating to its intersection, and the distance from it to the property. To sum it up, the address is a structure that depends on different types of numerical and non-numerical data, that, when organized together, allows the location of the property to be identified according to the urban road structure.
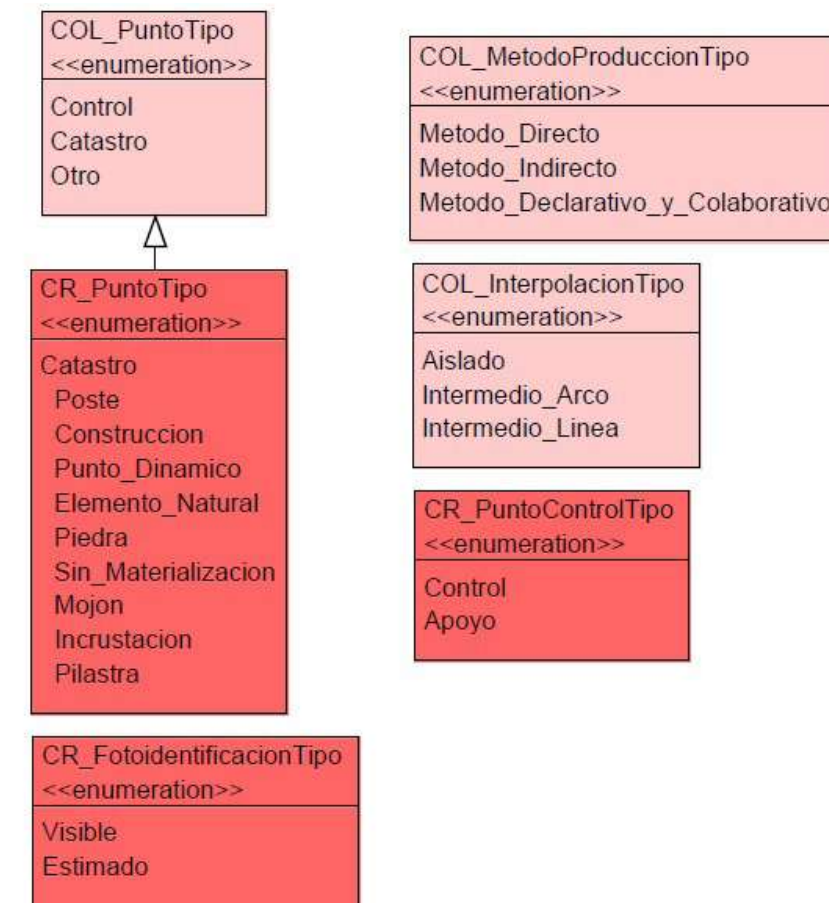

Figure 14. MECR Surveying and Representation Subpackage Domains Version 4.0.
Source: IGAC (2023)

Understanding the functionality of the structure tables, those contained in the LADM-COL Extended Model Cadastre-Registry can be appreciated in Figure 15.
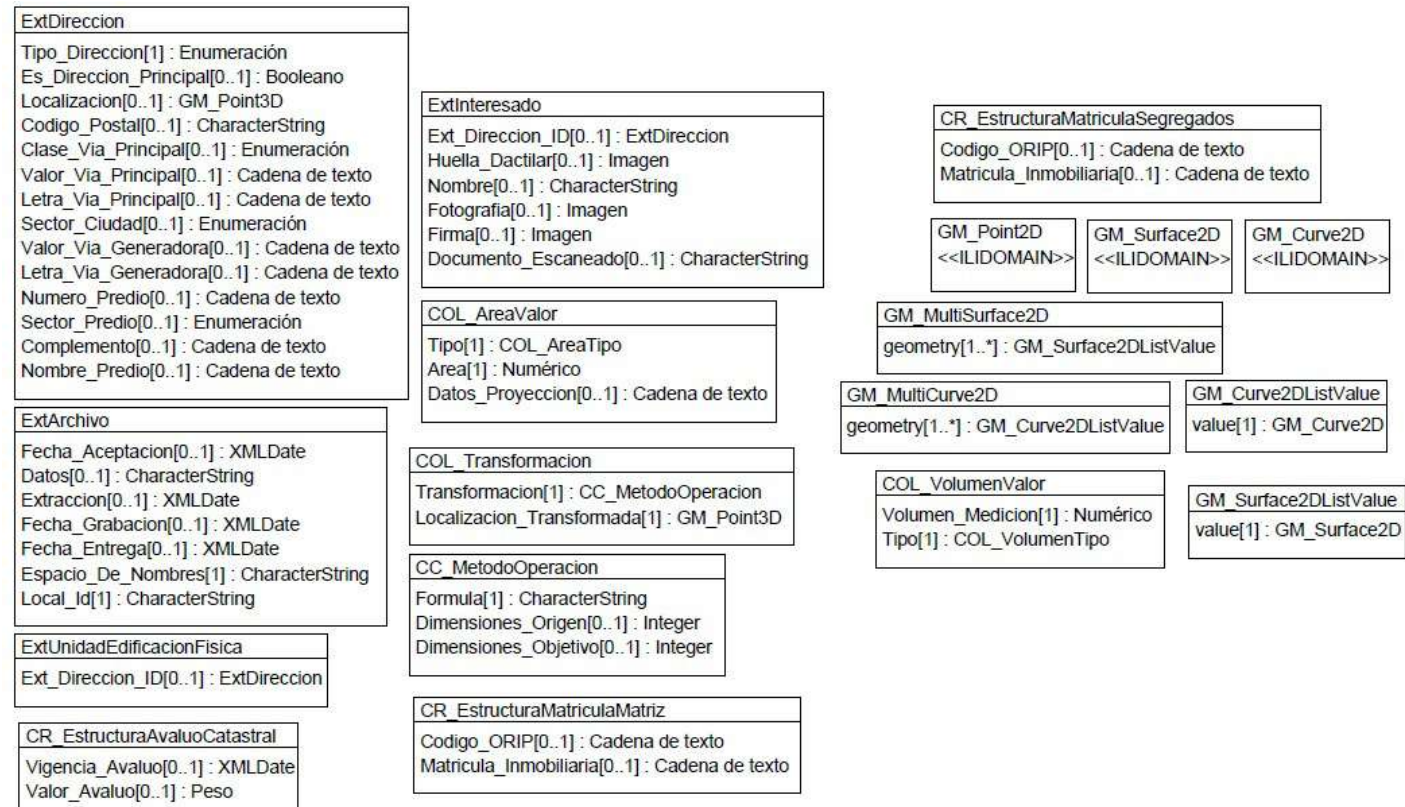

Figure 15. Structures Present in the MECR Version 4.0. **Source:** IGAC (2023)

Conclusions

This document presents the Extended Model Cadastre-Registry version 4.0, which is the product of the necessities identification to achieve the correct characterization of the property in cadastral management processes, therefore, its different versions allow to make adjustments for it to fit the Colombian cadastral reality.

The LADM-COL Extended Model Cadastre-Registry version 4.0 incorporates the minimum set of variables essential to characterize properties in Colombia. When comparing it with previous versions, it is noticeable the removal of redundant variables, like the case of the Tiene_Area_Registral attribute of MECR version 3.2, which was removed from the current version, leaving only the Area_Registral attribute. Similarly, version 4.0 has excluded variables such as Clase_Suelo, which is associated with a territorial planning extended model that exceeds the cadastre-registration relationship. The cadastral record becomes the variable that allows to identify whether the property is in a rural or urban area.

On the other hand, it is important to point out that some new classes such as CR_TramiteCatastral, of the Administrative Package, allow the IGAC, as a cadastral authority, better information governance, thus achieving greater efficiency and effectiveness in its internal processes.

Finally, the LADM-COL Extended Model Cadastre-Registry version 4.0 is designed to allow, through interoperability, to have such information available for analysis, giving a better context of the country's territorial information. This capacity provides the basis for the formulation of public policies that are aligned with the national reality, seeking to promote the social and economic development of the country.

References

Agustín Codazzi Geographic Institute (2023). *LADM_COL models.* https://igac.gov.co/catas-
tro-multiproposito/ladmcol