

Methodology to improve urban cadastral cartography in the Spanish Cadastre

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Are the legal boundaries very different to the fiscal ones?

.....If you have a continuous map with legal and no legal parcels without gaps and overlaps..... then they must be very similars.



...if the map that Finland cadastre shows to users is de cadastral index map.....if you want to improve the quality This means improve the quality of the cadastral index map



If there are the digital coordinates but they are different and less precise than the surveyor maps.....why not try to improve the digital ones,is possible?

Why to keep 2 different ?

Digital It is continuousisn't it more effective than one by one?



If the reliability is what users use

Is the reliability the legal boundary or the cadastral index map?



- Administrative Register (Ministry of Finances)
- Available to public policies and citizens requiring information from the Territory (by Law)

The cadastral description of the real estate will include its physical, economic and legal characteristics as location, cadastral code or ID, surface, use, crops, cartographic representation, cadastral value, titleholder, etc.

URBAN



RURAL



SPECIAL

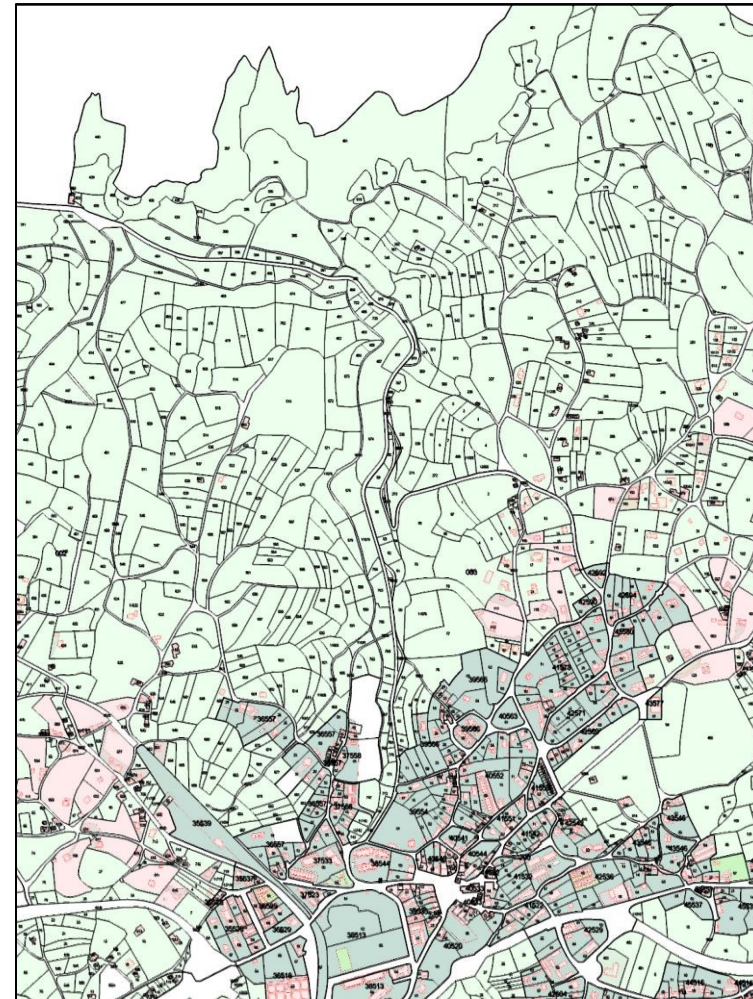




Main task for the Spanish cadastre: Valuation
Our values are the base for taxation
Main income for municipalities

The Cadastral GIS

The cadastre has information on
all rural and urban parcels in a
**homogeneous way, as a
territorial continuum,**





Spanish law establishes that the Cadastre is a register describing rural and urban real estates.



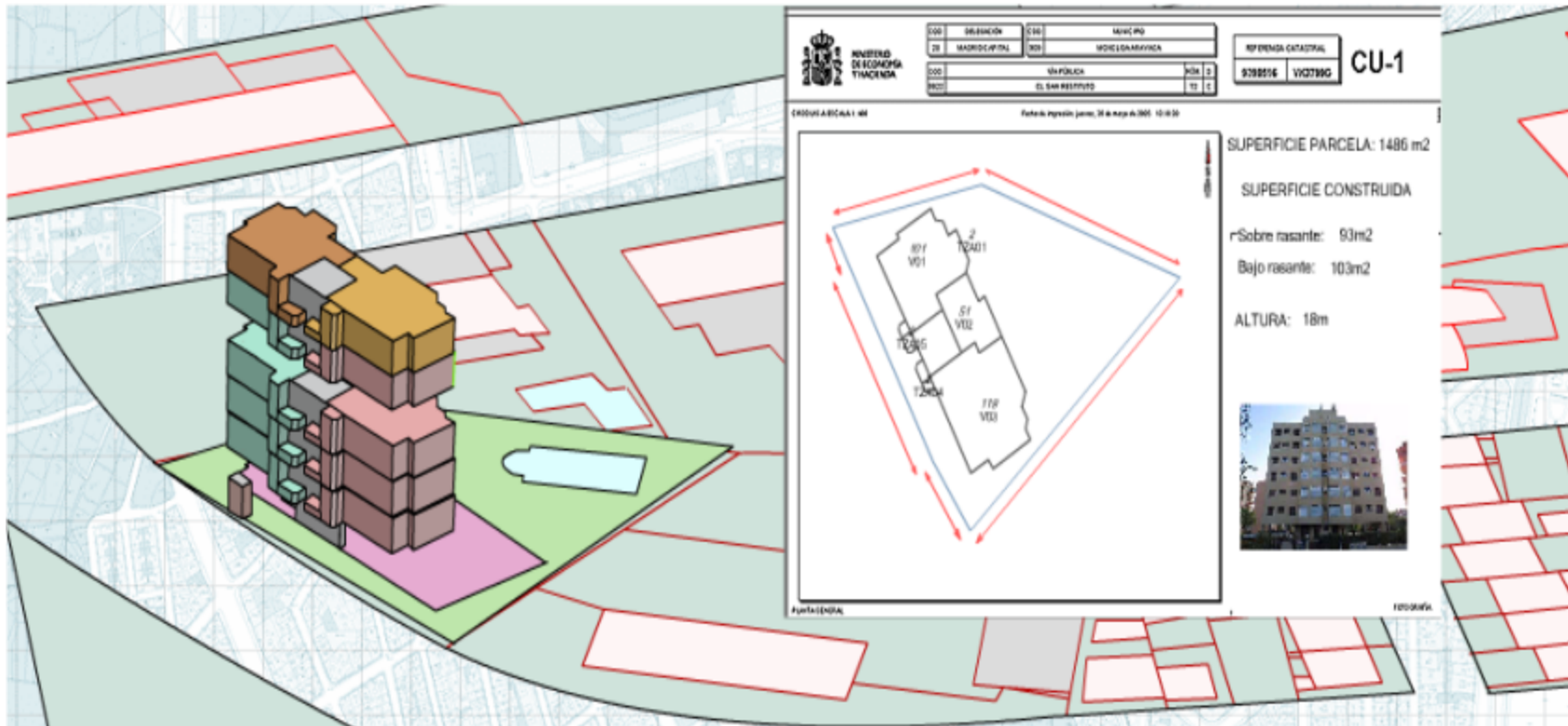
- **Real Estate Identification data:**
 - cadastral reference, province, municipality, addresses or location.
- **Juridical data of real estate:**
 - Titleholders' name and national identity number, addresses of titleholders and the notification address, date of acquisition and rights data....
- **Physical data of real estate:**
 - land area, buildings area, class of crops, coordinates, conservation status, use (legal and actual one), construction typology, year of construction.....

Economic data of the real estates:

value of land, value of construction and cadastral value, criteria and valuating module, real estate taxable value, exemptions and benefits.

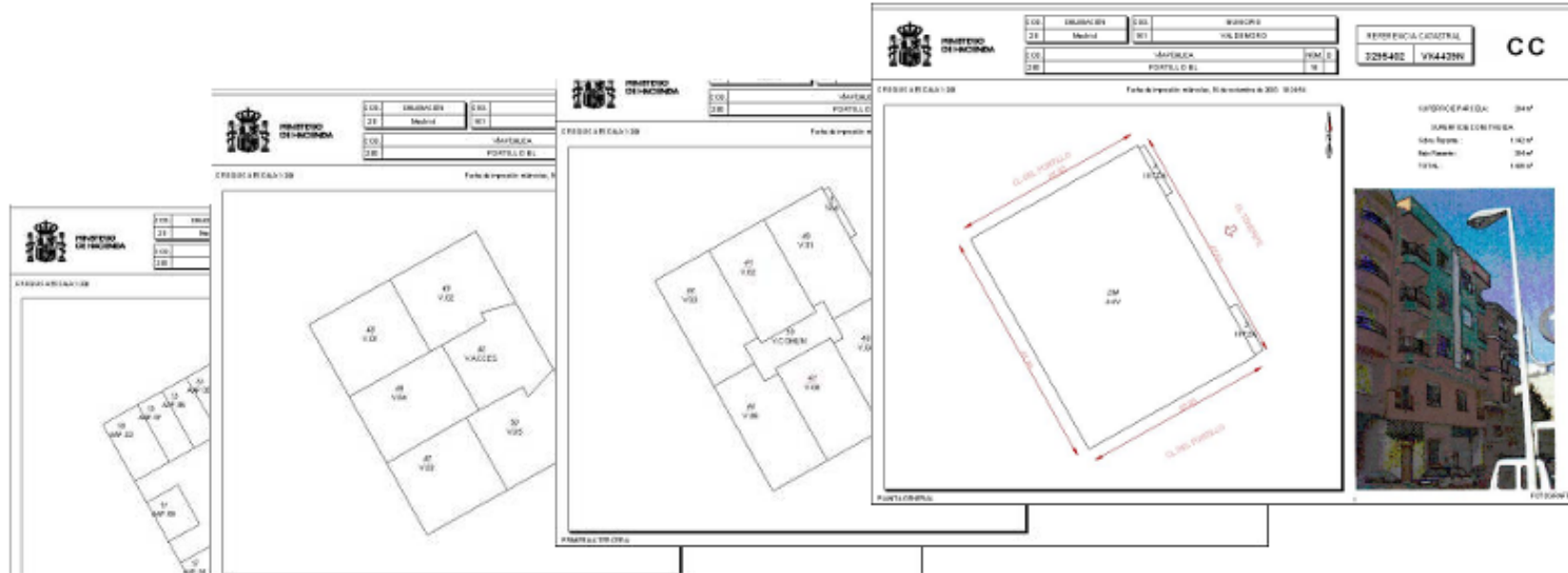


*Because we are a fiscal cadastre.
We can not have only information about the parcel or the building , we need more information.
We need the information inside the building , the distribution of each property, the common areas etc...*





For every building we have a document with scaled graphic representation of the properties forming an urban real estate building.



All the different floors and interior spaces are represented .

Also a digital photo of the building

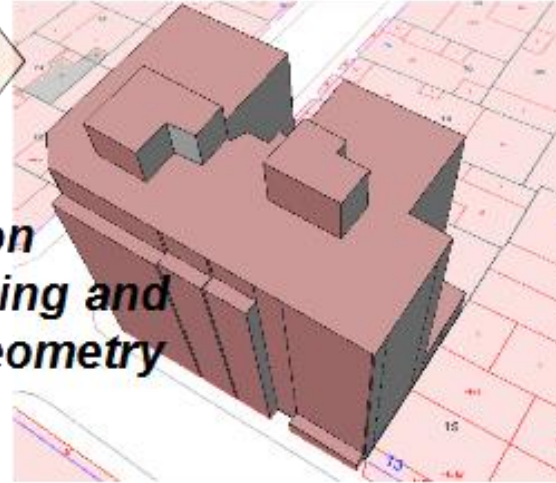
This document is stored in the system as documental information and link up to parcel data by means of the cadastral reference



3D MODELING

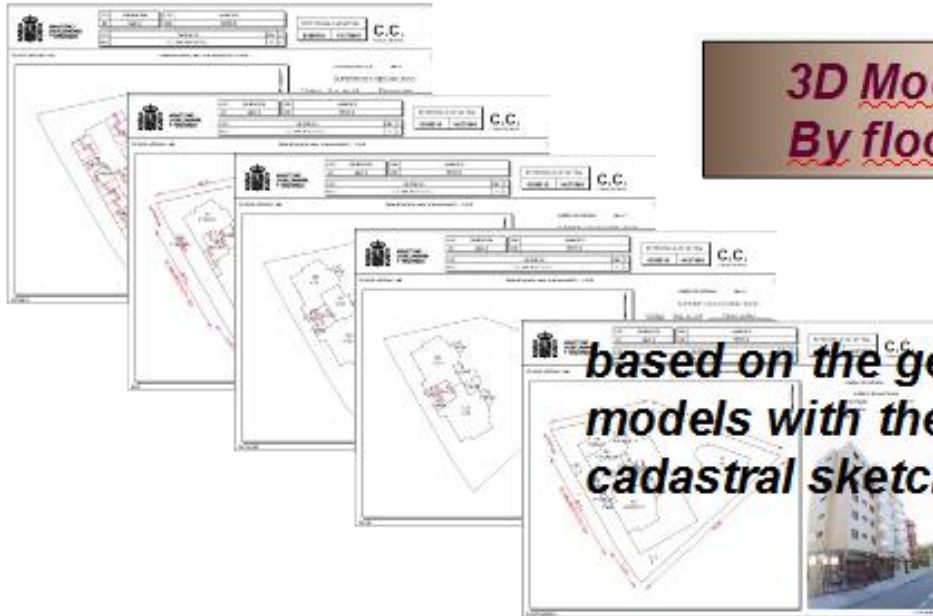
3D Model General floor

Based on modeling by extrusion on the basis of cadastral mapping and the attribute of construction geometry to get the "z" component



3D Model By floors

based on the generation of independent units models with the vector information of the cadastral sketch by plants





2002

2008



4D cadastre...3D + time



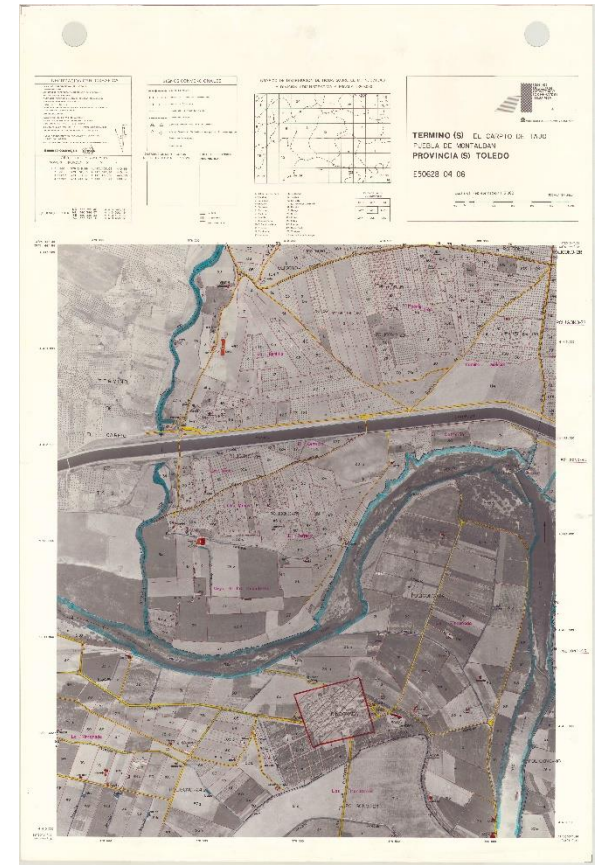


Cadastral Cartography

More than a century of cartographic works

- Topographic survey
- Photogrammetry
- In 70'S urban maps over topographics maps
- In the 90'S to 2002
 - Ortophotography and field Works to update rural maps
 - Digital cartography
- From them digital manteinance

In 2004: cartography in internet





TOPOGRAFÍA CATASTRAL

DE

ESPAÑA.

PROVINCIA DE MADRID.

PARTIDO JUDICIAL

COLMENAR VIEJO.

Ayuntamiento

Fuencarral.

Término

Fuencarral.

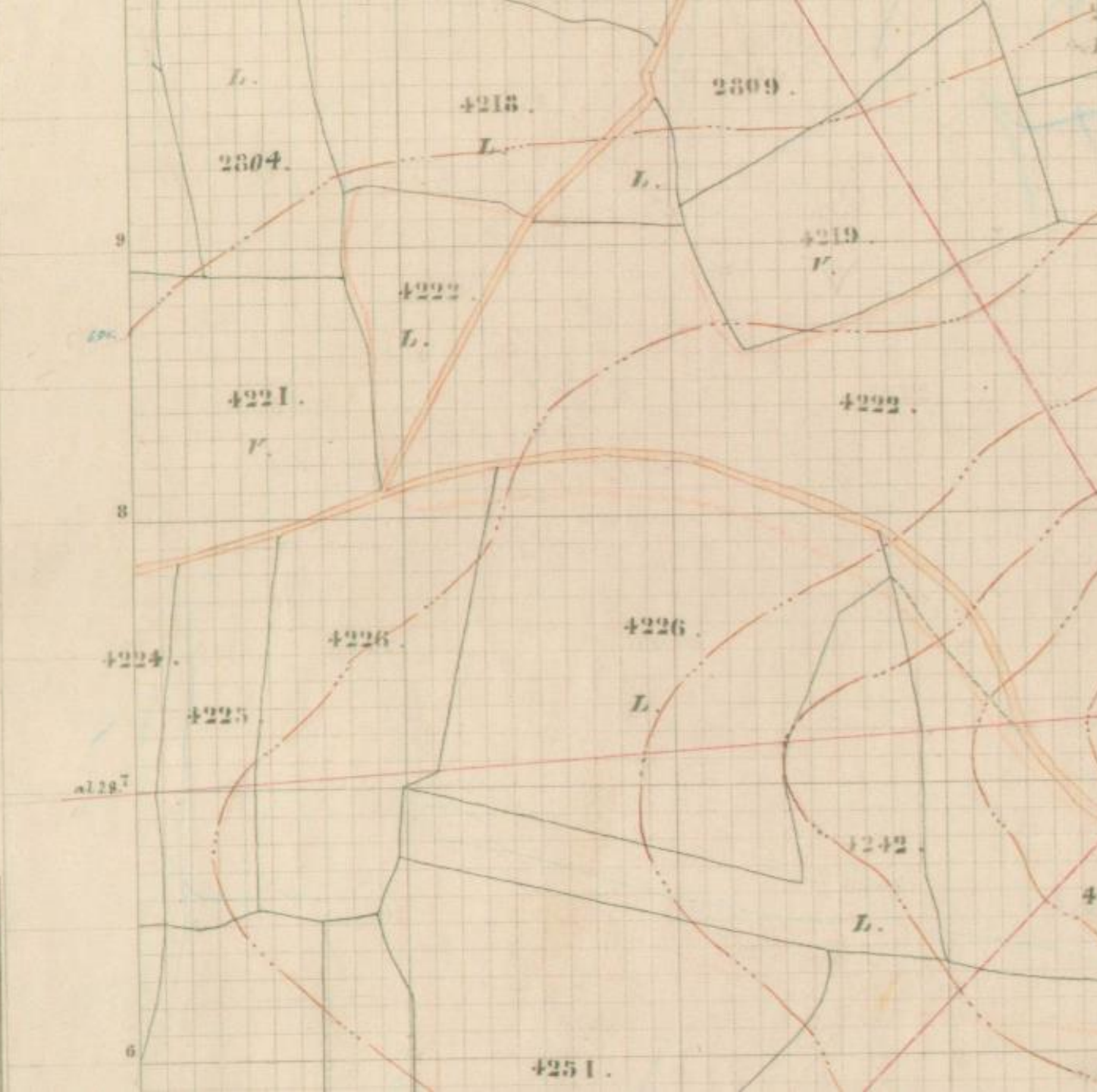
HOJA KILOMÉTRICA *KI.*

Escala: $\frac{1}{2.000} = 0.0005$.

Las cuadrículas de líneas finas representan áreas; las de líneas gruesas hectáreas. Las curvas de nivel equidistan cinco metros.

Situaciones.

Designación de los puntos.	Distancias.		Módulo.
	del punto anterior al actual	del actual al siguiente	
Vértice 20	2.695.11	1.326.22	327.12





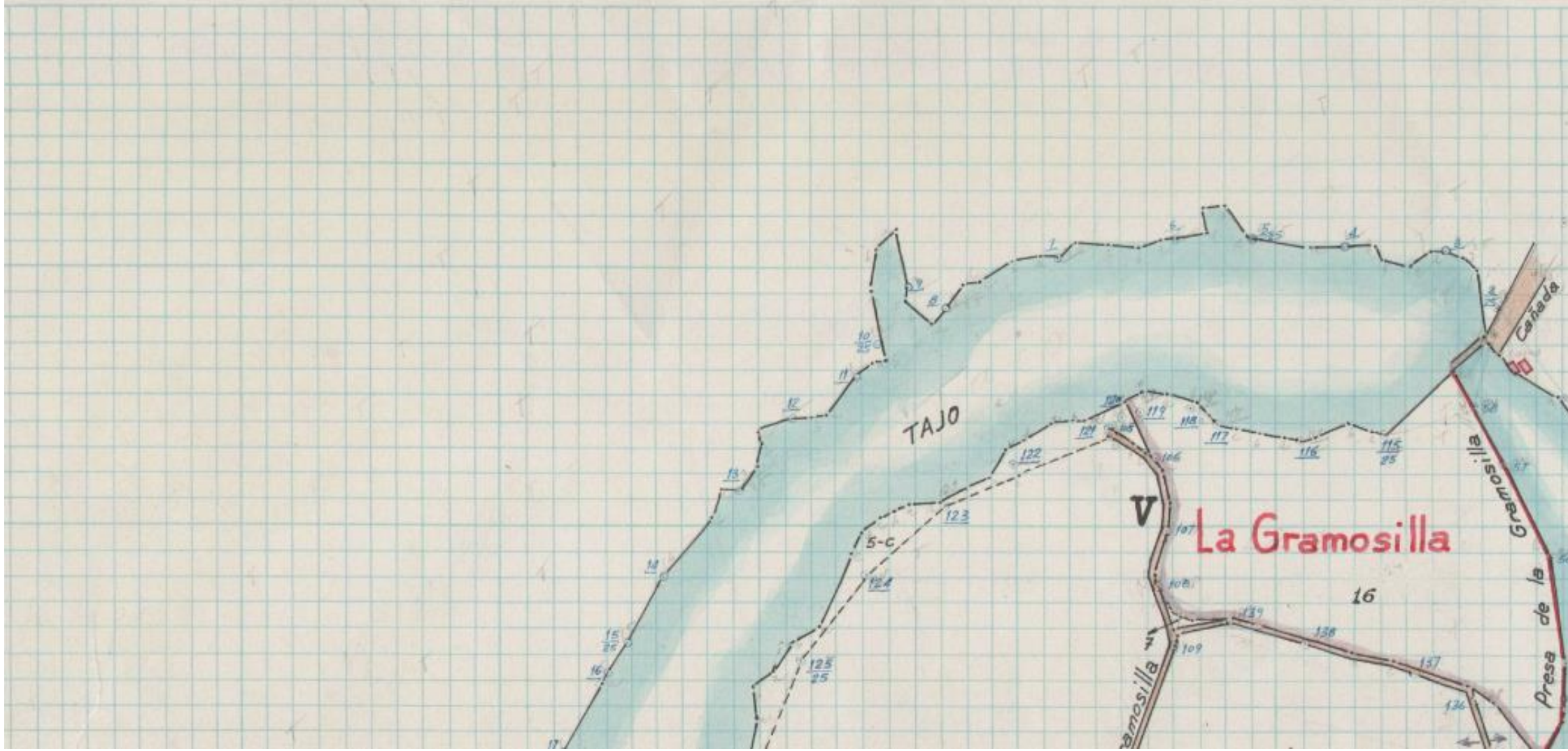
CATASTRAL

Término municipal de La Puebla de Almoradiel

Polígono núm. 24

ARCELARIO

1 3 n o p q







FECHAS DE ACTUALIZACION

29

1018-6	1018-7	1018-8
1018-11	1018-12	1018-13
1018-16	1018-17	1018-18

ESCALA 1:1.000

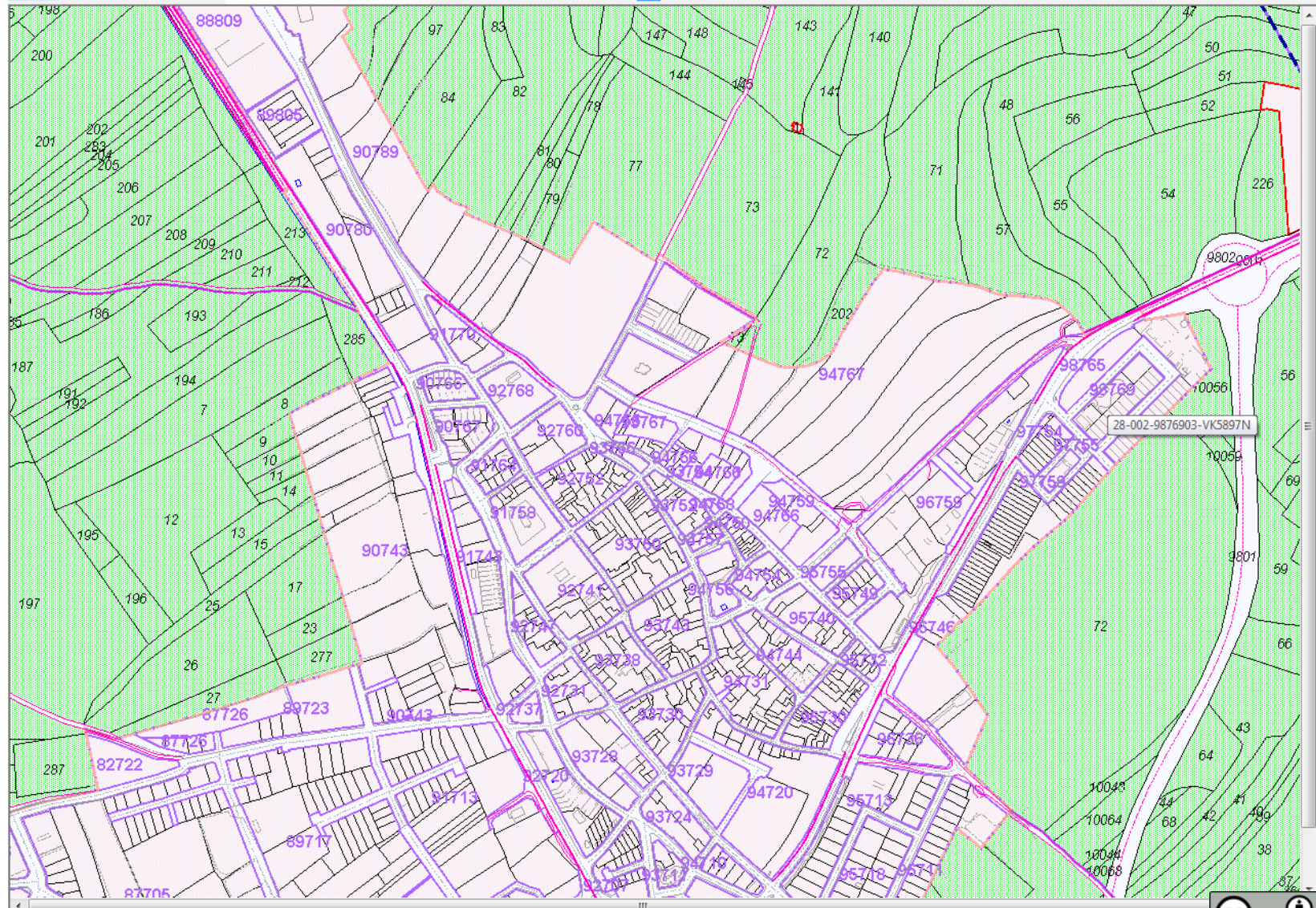


- PLANTA
- PLANTA
- PLANTA

SIGCA (Cadastral GIS)

SIGCA - Sistema de información geográfica catastral - SUMUM@BDCPRO_BDC_ONLINE - 28 - Cartografía oficial

Archivo Edición Impresión Ver Herramientas Mapas de fondo Ponencias ZonaValor DeteCar Ventana Ayuda





Cartography in electronic website

Bienvenidos Benvindos Benvinguts Welcome 04/12/2013 23:33:37
Sede Electrónica del Catastro

Bienvenido a la Sede Electrónica de la Dirección General del Catastro (SEC).
Desde esta plataforma puede acceder de forma segura a los servicios electrónicos p

Ciudadanos, empresas y profesionales

Acceso libre

- Consulta de cartografía, datos catastrales y búsqueda de referencia catastral
- Cotejo de documentos mediante código seguro de verificación (CSV)

Acceso con certificado o DNI electrónico

- Guía de firma electrónica en la SEC
- Guía de procedimientos catastrales

Procedimientos catastrales:

- Consulta y certificación
- Declaraciones
- Solicitudes
- Recursos

Servicios:

- Notificación de nuevos valores catastrales
- Consulta del estado de los expedientes
- Relación de accesos a información de inmuebles de un titular
- Modificar el estado de las certificaciones solicitadas por el Titular
- Consulta y descarga masiva de datos

Contraseña:
Nueva contraseña o usuario caducado
Acceso con certificado o DNI electrónico

Solicitud de alta como usuario registrado

- Alta de un Punto de Inf.
- Alta de un usuario regis

NOTIFICACIÓN ELECTRÓNICA DEL VALOR CATASTRAL

Sede Electrónica del Catastro • Secretaría de Estado de Hacienda y F

Inicio • Consulta de Datos Catastrales

SOLO cartografía catastral Provincia:

Medida de distancias y superficies

X	Y	Distancia (m)	Superficie (m²)
440367.04	4474529.15	159.59	
440381.81	4474498.87		1644.63
440422.26	4474511.54		
440412.06	4474545		
440392.01	4474542.89		
440367.39	4474528.8		

Consulta Espacial

- Por Polígono
- Por Línea

X: 440381 Y: 4474498

0 50 m.

440381 Y: 4474498

Sitios de confianza 100%

From 2004 The cadastral maps are free and open to everyone for viewing and download , 24x7

**Annual maps download:
over 180 M**



Cartography in electronic website



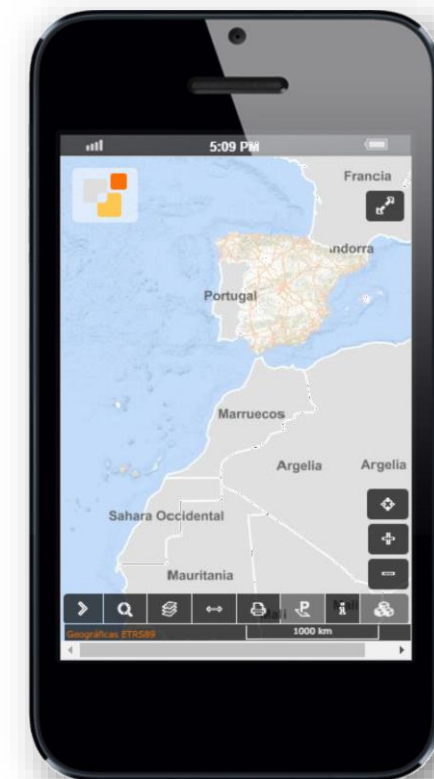
We have continuous cartography of all our territory of management (almost 500,000 km²)

available through the electronic office,

viewer that allows users to navigate from an overview of the complete territory to approach each one of the parcels and units

and also through the map access to the most relevant alphanumeric characteristics of them.

Viewer



<https://www1.sedecatastro.gob.es/Cartografia/mapa.aspx>



The fiscal Cadastre has become a Multifunctional Cadastre

Legal security and fraud control in real estate traffic:

Location and identification of the properties.

The cadastral reference as "Real estate identifier" in deeds- Rg. Property / Tax ation/ Contracts / Valuations

Social and aid policies

Energy reports

Policies, infrastructures, services

- Urban planning, land use
- Networks of services and supplies
- Agrarian, environmental, building features
- Other rights, limitations and restrictions
- Risk maps, civil protection, emergencies
- Linking or support of statistical data (geo-statistics)





The fiscal Cadastre has become a Multifunctional Cadastre

This multiple use of the cadastre introduces requirements:

- New attributes and characteristics
- Link of the basic unit (cadastral parcel, building, real estate) with other object or attributes
- Necessity of geo-referencing and location of the events, acts, business and in general phenomena that occur in the territory



Need of a greater homogeneity of information (standardization and interoperability)

Need of access and exchange of cadastral information

Need to ensure a minimum **quality of the cartographic data**



Cadastral – Property Rights Registry Coordination



Law 13/ 2015 Goals



To give real estate traffic greater legal certainty by incorporating the **georeferenced** graphic information of the parcels in the Property Rights Registry,

- **the cadastral map** as the basis of its graphic representation,
- allowing simultaneously the updating and correction of the cadastral data.

The cadastral cartography is the basis of the Property Rights Registry

Once the cadastral data is coordinated by the Property Rights Registry, the **delimitation, location and area of cadastral data are considered to be true for all legal purposes.**



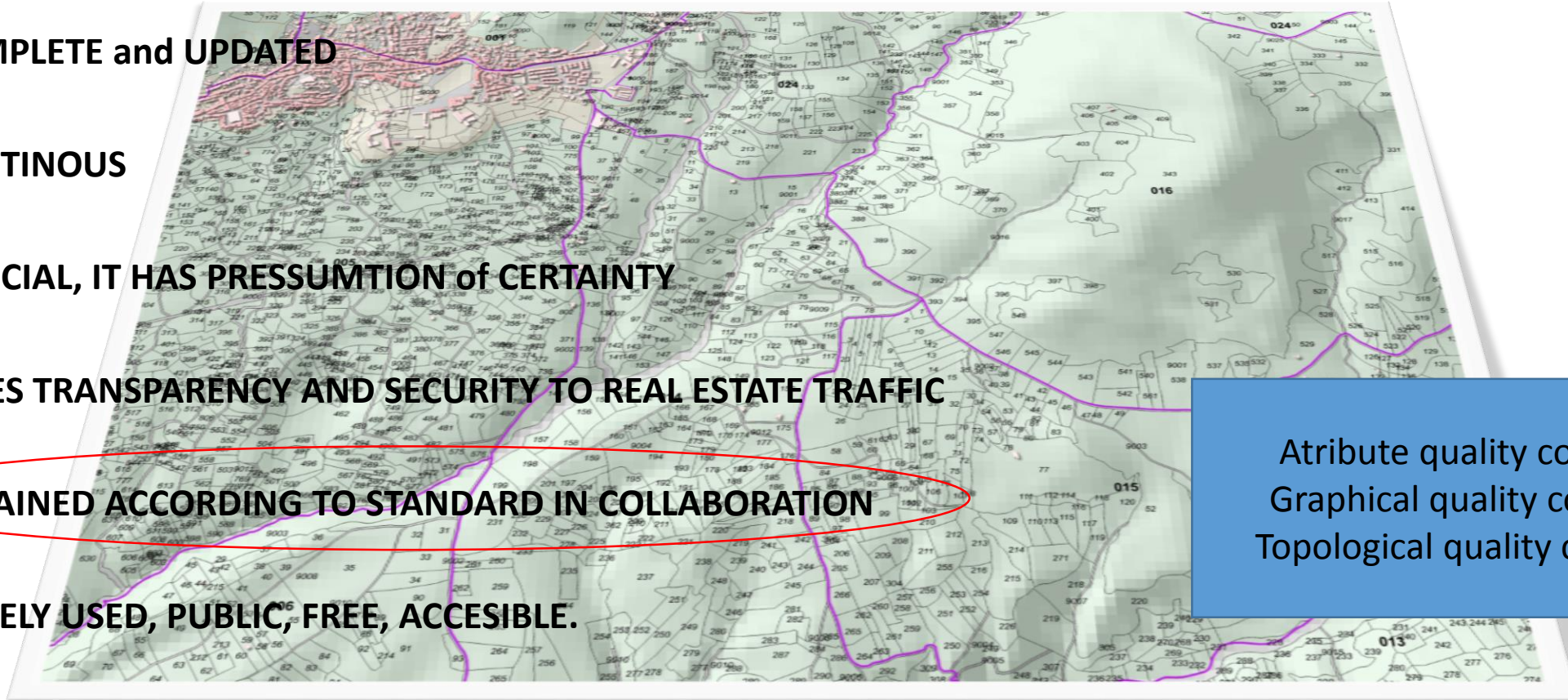
It obligue us to improve our quality



The cadastral cartography

- **COMPLETE and UPDATED**
- **CONTINUOUS**
- **OFFICIAL, IT HAS PRESUMPTION of CERTAINTY**
- **GIVES TRANSPARENCY AND SECURITY TO REAL ESTATE TRAFFIC**
- **OBTAINED ACCORDING TO STANDARD IN COLLABORATION**
- **WIDELY USED, PUBLIC, FREE, ACCESSIBLE.**

Atribute quality control
Graphical quality control
Topological quality control

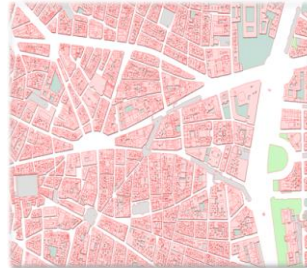




Cadastral basic data / Daily updating

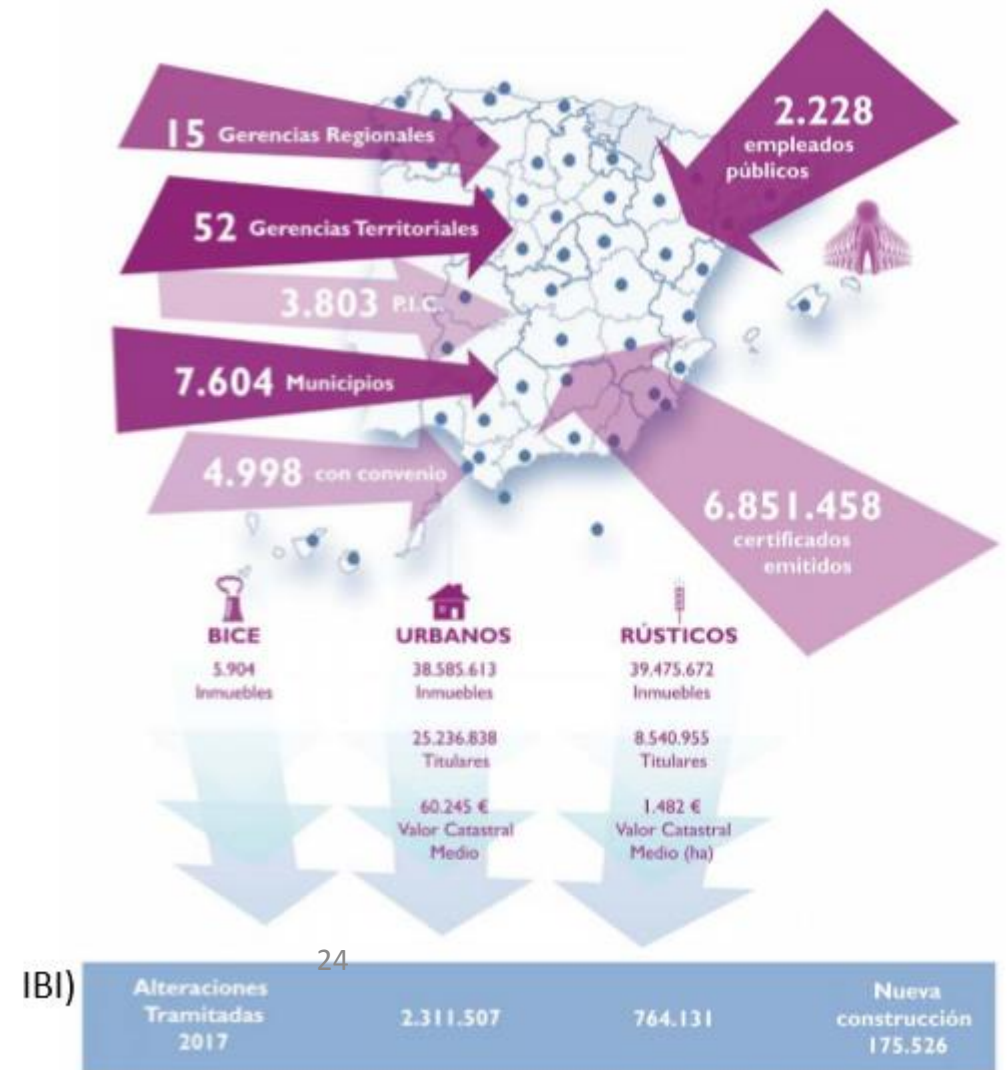
Urban Cadastre

- 1.062.636 ha maps 1/1.000 o 1/500
- 12 M de buildings
- 14 M cadastral parcels,
- 39 M urban units
- **6.500 real estate updated daily, 480 new constructions**



Rural Cadastre:

- 47.387.942 ha maps a 1:5.000
- 39,2 M parcels
- **2.500 real estate updated daily**





creation, update and maintenance of the cadaster in collaboration:

- Compulsory Declarations of titleholders
- Institutional collaborators
 - AGRICULTURAL MINISTRY
 - NOTARIES
 - PROPERTY RIGHTS REGISTRARS
 - SPANISH TAX AGENCY
- Collaboration agreements with municipalities and local and regional authorities
- Communications and supply of information from public administrations and other organisations; Public Domain managers, expropriations, land consolidation, highways, railways, etc.





creation, update and maintenance of the cadaster in collaboration:

Different origin

- Cadastral Survey
- On restituted topographic basis.
- On images basis(orthophotos, aerial photo)
- From documents (reparcelling, projects, etc.)
- other

In addition, the management and maintenance model can increase the differences:

- Plurality of actors: surveyors, architects, others
- Different sources of information:
 - sketches, photos, plans, maps, of different quality, scale,
- Different procedures.



Consequence:
the quality of the data can be very different.



In Spain there are not licensed surveyors and it is not obligatory to mark boundaries in the ground.

But any alteration of the real estate must be declared to the cadastre

Mostly, when the parcels have physical changes, it is a surveyor who include the new coordinates in the cadastre contracted sometimes by citizen but mostly by other public administration





New cartographic tools

- Change in cartographic technology: GIS, WEB services.
- Evolution of measuring devices: Decrease in size, costs, times, increase precision.
- Photogrammetry: multispectral sensors, cameras and digital images, automated processing, automatic correlation.
- Orthophotos, true ortho, LIDAR, mobilemapping
- Satellite images: Quality, frequency, resolution
- Change detection tools,

All this technology has improved the processes of data collection and also our ability to inspect changes or detect errors





Normas y estándares de calidad: exactitud posicional



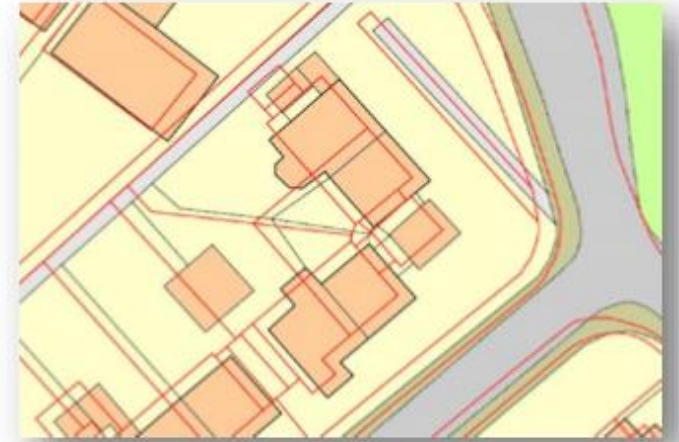
Compleción	Presencia y ausencia de fenómenos, sus atributos y relaciones.
Consistencia lógica	Grado de adherencia a las reglas lógicas de la estructura de los datos, atributos y relaciones.
Exactitud posicional	Exactitud de la posición de los fenómenos.
Calidad temporal	Exactitud de los atributos temporales y de las relaciones temporales de los fenómenos.
Exactitud temática	Exactitud de atributos cuantitativos y corrección de no cuantitativos, y de las clasificaciones de fenómenos y sus relaciones.
Usabilidad	Cumplimiento de unos requisitos.

- NMAS - National Map Accuracy Standard (USGS 1947)
- EMAS – Engineering Map Accuracy Standard (ASCI 1983)
- ASPRS – Spatial Accuracy Specifications for Large Scale Topographic Maps (ASPRS 2006)
- NSSDA – National Standard for Spatial Data Accuracy (FGDC 1998)
- Método Francés (Orden Ministerio de Equipamiento 2003)
- STANAG 2215: Standardization Agreement, Evaluation of land maps, aeronautical charts and digital topographic (STANAG 2002)
- NORMAS ISO 19157

Improvement of positional accuracy

Some considerations:

- Making new more accurate cartography is very very expensive....impossible
- Improve the accuracy and precision of a map, it is also expensive
- The precisions and scales of the cadastral cartographies must be reasonable and proportional (urban, rural).
- A plan of a parcel, a specific demarcation of a piece of land ,is not the same as doing all the cartography of the country.
- There are already proven programs to improve the positional component (PAI)





One of the current strategic objectives of the D.G. of the Cadastre

Purpose:

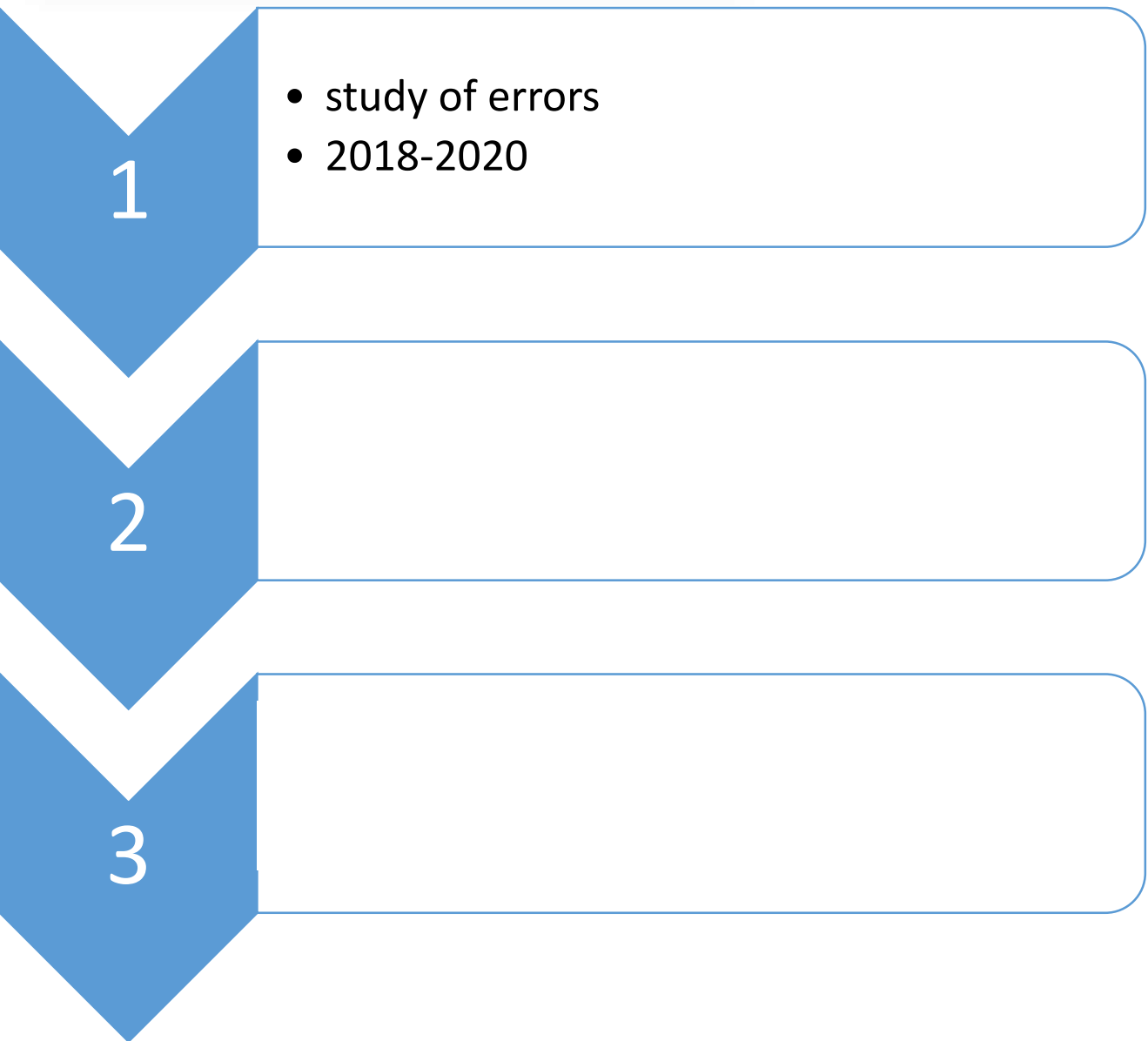
Provide the cadastral cartography of all the characteristics that allow compliance with the provisions of Law 13/2015

Improvement objectives:

- Correction of the cartography in its component of positional accuracy.
- Adjustments necessary to improve the agreement between the cadastral parcel and the reality.

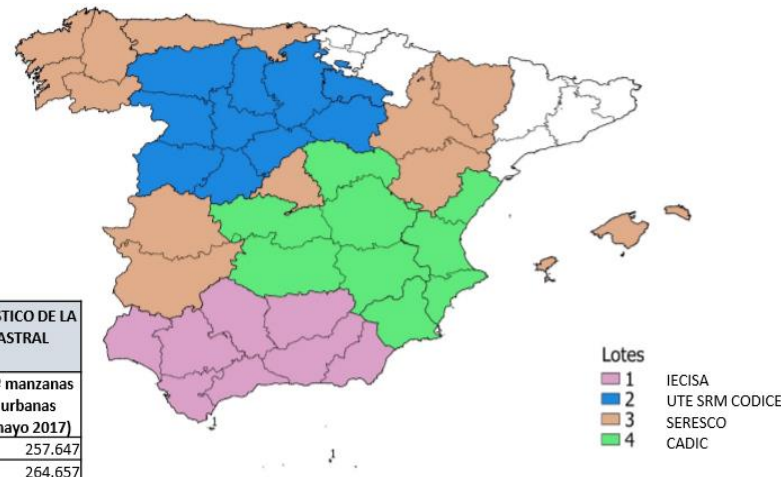


First urban cartography



First step

Study of positional accuracy of urban blocks
 Contract private surveyor companies.
 Big investment. All territory



CONTRATO DE SERVICIO DE ANÁLISIS Y DIAGNÓSTICO DE LA CALIDAD MÉTRICA DE LA CARTOGRAFÍA CATASTRAL URBANA		
Lote	Ámbito geográfico	Nº manzanas urbanas (mayo 2017)
1	Andalucía, Ceuta y Melilla.	257.647
2	Castilla y León y La Rioja.	264.657
3	Aragón, Cantabria, Comunidad de Madrid, Extremadura, Galicia, Islas Baleares y Principado de Asturias	319.486
4	Castilla - La Mancha, Comunidad Valenciana y Región de Murcia.	290.762
TOTAL		1.132.552

Cataluña y Canarias: previstas otras actuaciones



Previous conceptual analysis: PRECISION, TOLERANCE, ERRORS

- **PRECISION:** The accuracy of CATASTRAL CARTOGRAPHY responds to the scale and technique used in its survey and to the techniques of subsequent maintenance:
- **TECHNICAL TOLERANCE MARGIN:** Accuracy of the graphic measurement according to the scale of representation. Defined in cadastral regulation
- **ERRORS OF GYRATION AND DISPLACEMENT:** Between the plot and the cartographic support base used.
- **POSITIONING ERRORS:** Between the coordinate of the plot and the measurement on the ground

- Cadastral Survey
- On restituted topographic basis.
- On images basis(orthophotos, aerial photo)
- From documents (reparcelling, projects, etc.)
- other



Now
Better basic information



The national Plan of Aerial orthophotography (PNOA)

It is a decentralized and cooperative production between the different administrations

Aims to obtain digital aerial orthophotographic images with resolution **10, 25 or 50 cm**

With an update period of 2 or 3 years, depending on the zones.

Aerial photography is the obligatory basis for the realization of cartography and geographic information: land occupation, urban planning and territorial planning, cadastre, forest management, hydrography, etc.

Using the same Photogrammetric data, we also achieve a perfect geometric and temporal coherence of the cartographic and geographic databases existing in all the administrations.



7,6 M euros
each 3 years





A single photogrammetric flight and rigorous data processing are carried out in compliance with the technical specifications agreed upon by all the participating public administrations that co-financing the production.

	GSD Vuelo (cm)	GSD Ortofoto (cm)	Exactitud planimétrica de la ortofoto	Exactitud altimétrica del Modelo Digital del Terreno	Paso de malla
PNOA 50 cm	45	50	$RMSE_{x,y} \leq 1,00 \text{ m}$	$RMSE_z \leq 2,00 \text{ m}$	5m x 5m
PNOA 25 cm	22	25	$RMSE_{x,y} \leq 0,50 \text{ m}$	$RMSE_{x,y} \leq 1,00 \text{ m}$	5m x 5m
PNOA 10 cm	9	10	$RMSE_{x,y} \leq 0,20 \text{ m}$	$RMSE_{x,y} \leq 0,20 \text{ m}$ (con LiDAR)	1m x 1m

Características Técnicas



Study of errores

The positional accuracy of cadastral cartography shall be calculated by reference to the orthos of the *Plan Nacional de Ortofotografía Aérea (PNOA)*

- It's official and ensures compliance of the quality controls
- It covers the entire territory
- accuracy: is considered the minimum standard for cadastral purposes.

Other cartographic products of best quality metric may be used.
Prior authorisation by the cadastre.





Study of positional accuracy of urban blocks

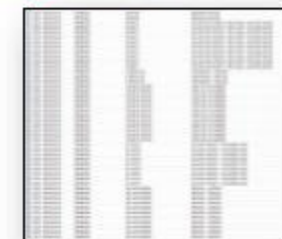
The surveyor company must provide:

- Vectors of transformation: identification of homologous points between the cadastral maps and reference cartography or orthophoto reference. Block by block.
- Zones: homogeneous zones of set of blocks with its parameters of transformation for its rectification.
- The level of correspondence of the cadastre with the physical reality
For this, the discrepancies found will be classified according to their typology. Catalog of incidents
- Quality by municipality : prioritization of action.

SHP file, with the homologous points captured in the cadastral cartography and in the reference data source.



$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = \begin{bmatrix} a_{11} & a_{12} & t_x \\ a_{21} & a_{22} & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} x \\ y \\ 1 \end{pmatrix}$$





After the Study

- We will know the quality of metric positioning of each block of each municipality in the urban cadastral cartography.
- We can evaluate which actions or new cartography must be done
- Before carrying out correcting works, we can notify N+R of the mismatch in each area so that they can take it into account.
- In the zones that are susceptible to transformation we will know what parameters can be applied to make an automatic transformation in all layers of cartography



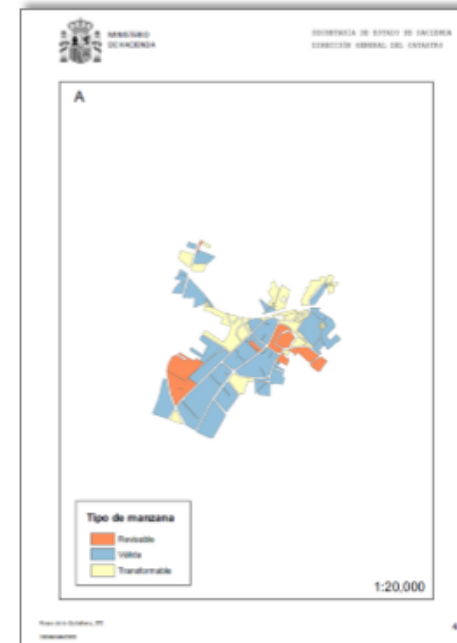


Resumen de resultados

Total recintos	Total vectores	Manzanas validas	Manzanas transformables	Manzanas mal catastradas	Manzanas no transformables	Recintos con omisiones	Recintos con comisiones
NUM_RE	NUM_VE	NUM_MZ_OK	NUM_MZ_TR	NUM_MZ_NP	NUM_MZ_KO	NUM_OMI	NUM_COMI
137	527	60	55	17	5	0	0

Análisis de parámetros de transformación y residuos

Número recintos con masas transformables	Número vectores	Longitud media de vectores	Media RMS vectores	Media RMS transformaciones
NUM_RE_TR	NUM_VE_TR	LONG M VE	RMS M VE	RMS M TR
55	234	0,764	0,382	0,363



This is only the first step, the diagnosis.

Then we should decide which blocks are transformed automatically.

Notification to the owners and attention to the allegations ... new surfaces, new values.

Blocks not transformable, individual analysis and field work

And then extend the study to rural areas, more difficult.

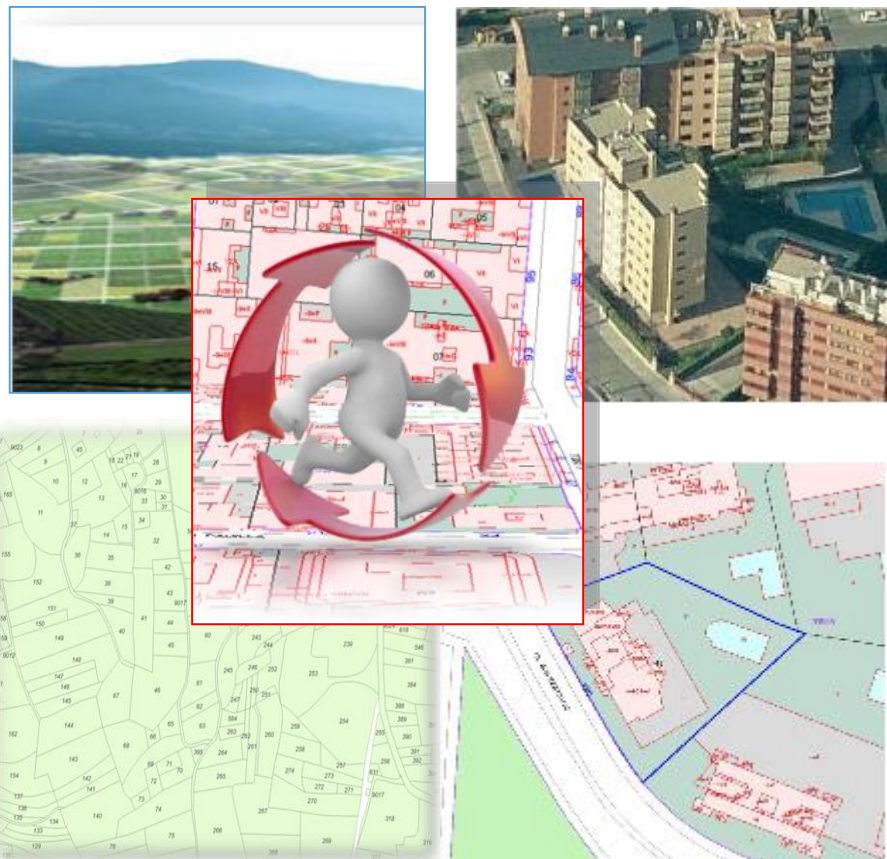
assessment

diagnosis

planning

implementation

evaluation



Thanks for your attention!!!

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