3D Modeling and Representation of the Spanish Cadastral Cartography

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MINISTERIO DE ECONOMÍA Y HACIENDA
SECRETARÍA DE ESTADO DE HACIENDA Y PRESUPUESTOS
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- ***Introduction about the Spanish Cadatre.***

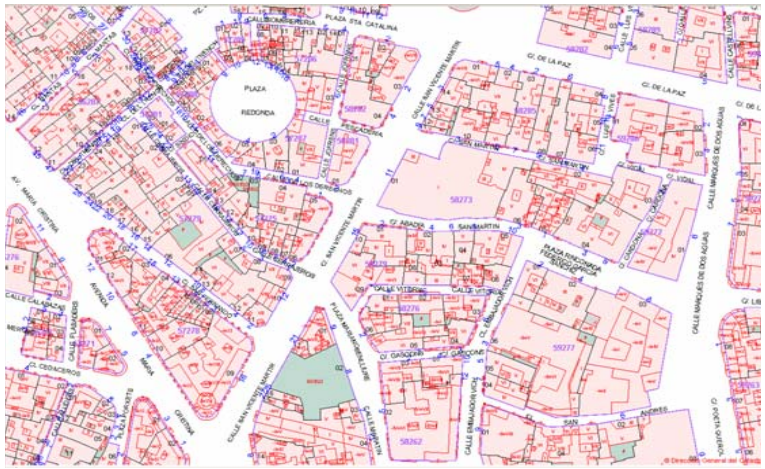
- ***WMS of the Spanish Cadastre and the 3D representaion of the cadastral cartography in the WMS***
    - ***Shadow representation***
    - ***Perspective representation***

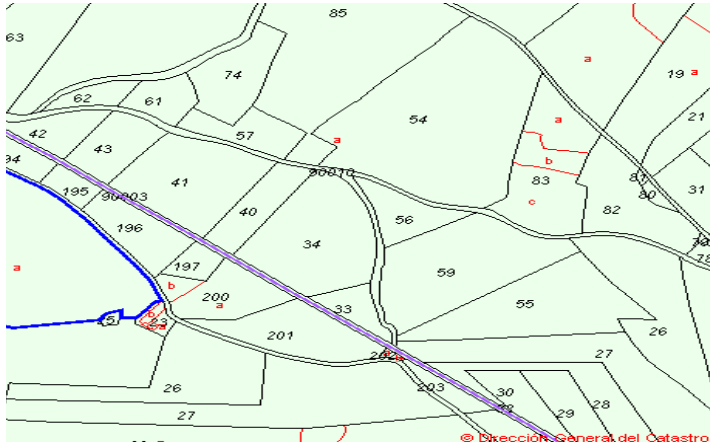
- ***3D modeling of the Cadastral cartogrphy***
    - ***3D modeling by general floor***
    - ***3D modeling by floors***

- ***Conclusions***

The Spanish Cadastre is a register describing rural and urban real estates.

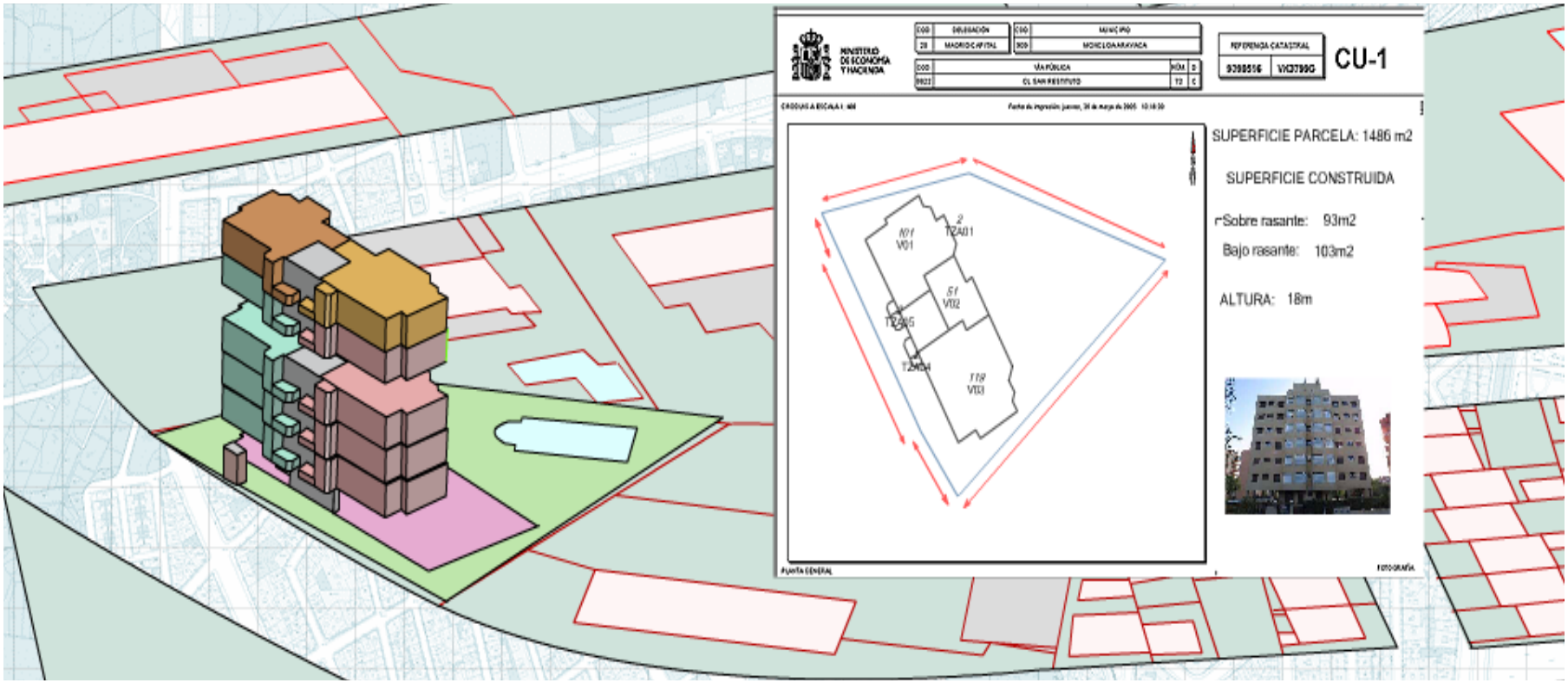
This description includes physical, legal and economic characteristics, location, cadastral reference, address, surface, uses, class of crop, buildings, graphic representation, time atributes, cadastral value and data of title holders (name, national identity number, address, type of title…….. and many other data



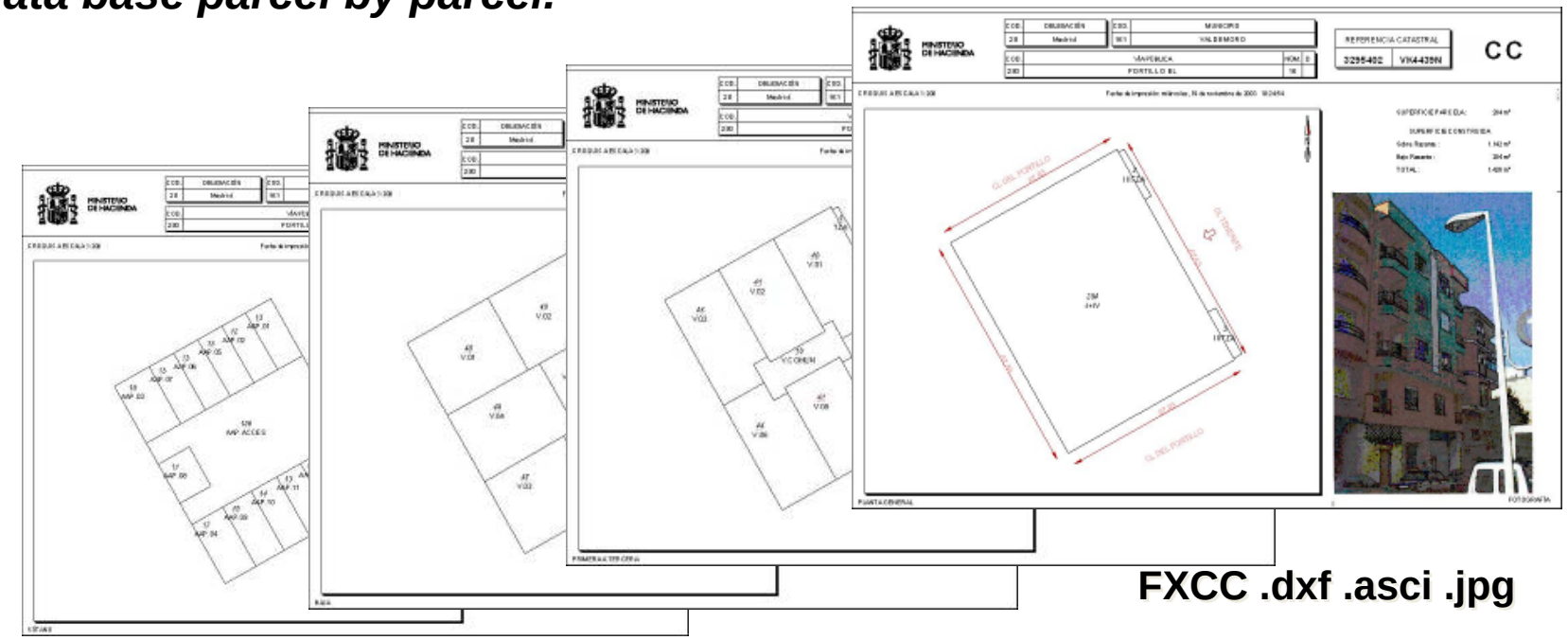


The Spanish Cadastre is principally a fiscal cadastre, whose databases of cadastral values of rural and urban real estate are the basis for the calculation of real estate tax and other local, regional and national taxes.

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...



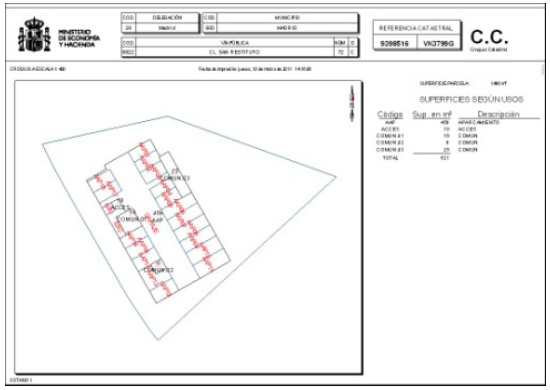
The FXCC document is a scaled graphic representation of the properties forming an urban real estate building.
In every FXCC the different floors and interior spaces are represented. The FXCC contains a digital photo of the building too and it is storaged in the data base parcel by parcel.

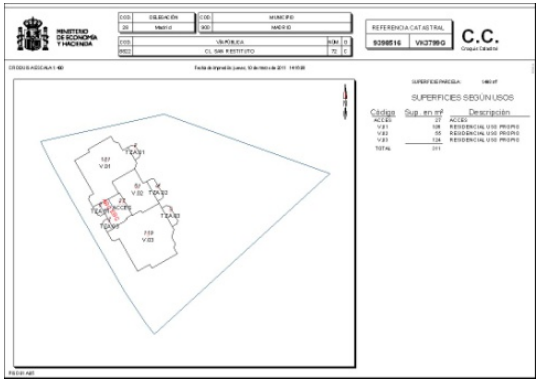


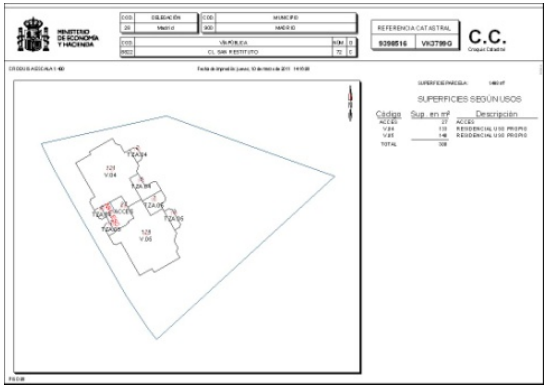
FXCC .dxf .asci .jpg

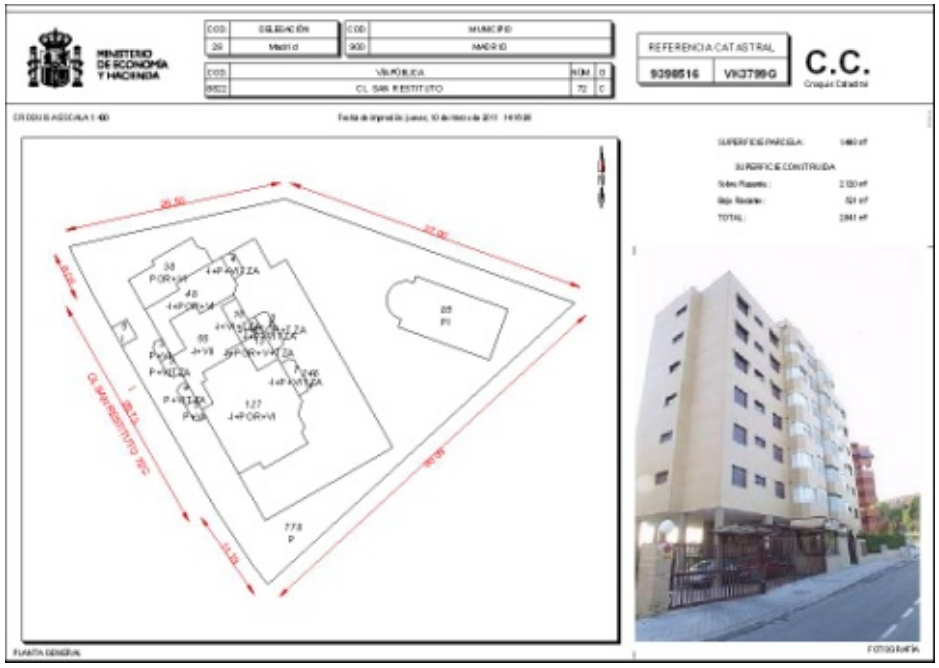
It is the exchange format with the colaborative entities: Notaries, municipalities, surveyors……

http://www.catastro.meh.es/catastro_en_si/formatos_intercambio/formato_fx-cc_2006.pdf







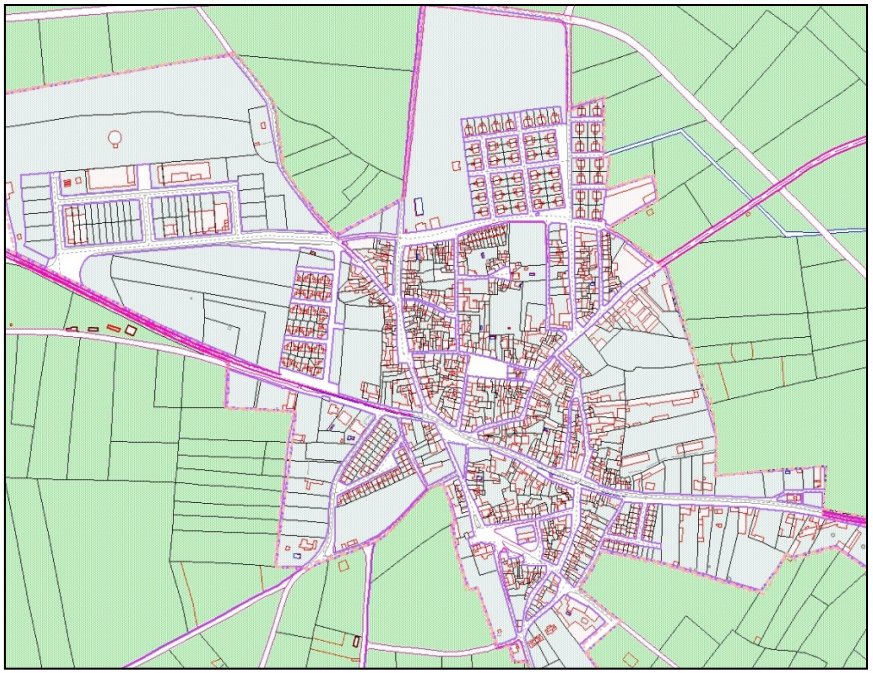


This document is stored in the system as documental information and link up to parcel data by means of the cadastral reference.

The Spanish cadastre has information of

-12 million urban parcels,
- 32 million urban units and
- 42 million rural parcels

in a continuos and uniform model



Unit of data capture: Municipality

Urban cartography :

1:500 and 1:1.000

Rural cartography:

1:2.000 and 1:5.000

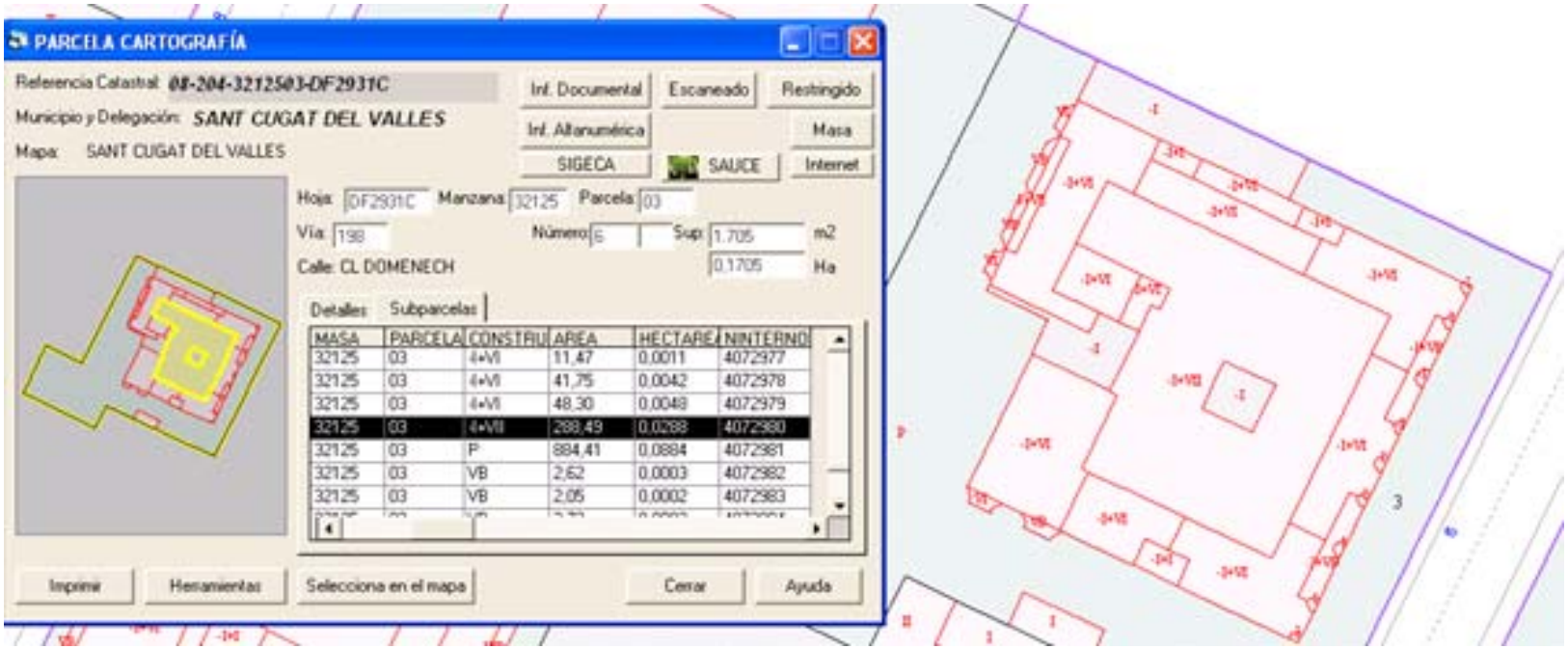
In Urban areas, the parcels contain urban units (flats, individualiced parkings, other units inside the real estate…..).

Each unit inside the parcel has his own cadastral reference, all the urban units of a parcel have the same first part of the cadastral reference

The link between alpha-numerical information and graphic data is achieved using the cadastral reference.

The parcelas are build by sub parcels, as volume constructed.

Cadastral cartography, even in only 2D, has the volumetric information of the buildings by number of plants in roman numerals in their maps.



Sede Electrónica del Catastro

Catastro español:
Spanish Cadastre:

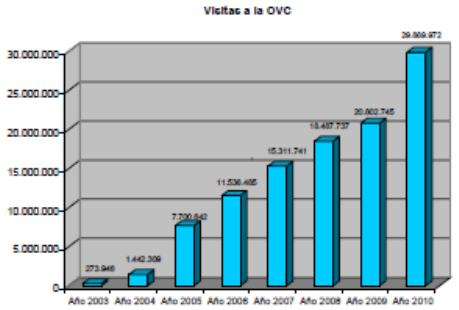
The Spanish cadastre is a pioneer public sector organisation in its facilitation of access and re-use of its data for free for both commercial and non-commercial purposes.

http:// sedecatastro.gob.es

The Spanish Cadastral Service by internet gives cost-free, easy, rapid, 24-hour, 7 days a week access to cadastral data

It has evolved from being a government tax collection and a real estate security service

to being a socially valuable tool since this data is used in an increasing number of application and new services.



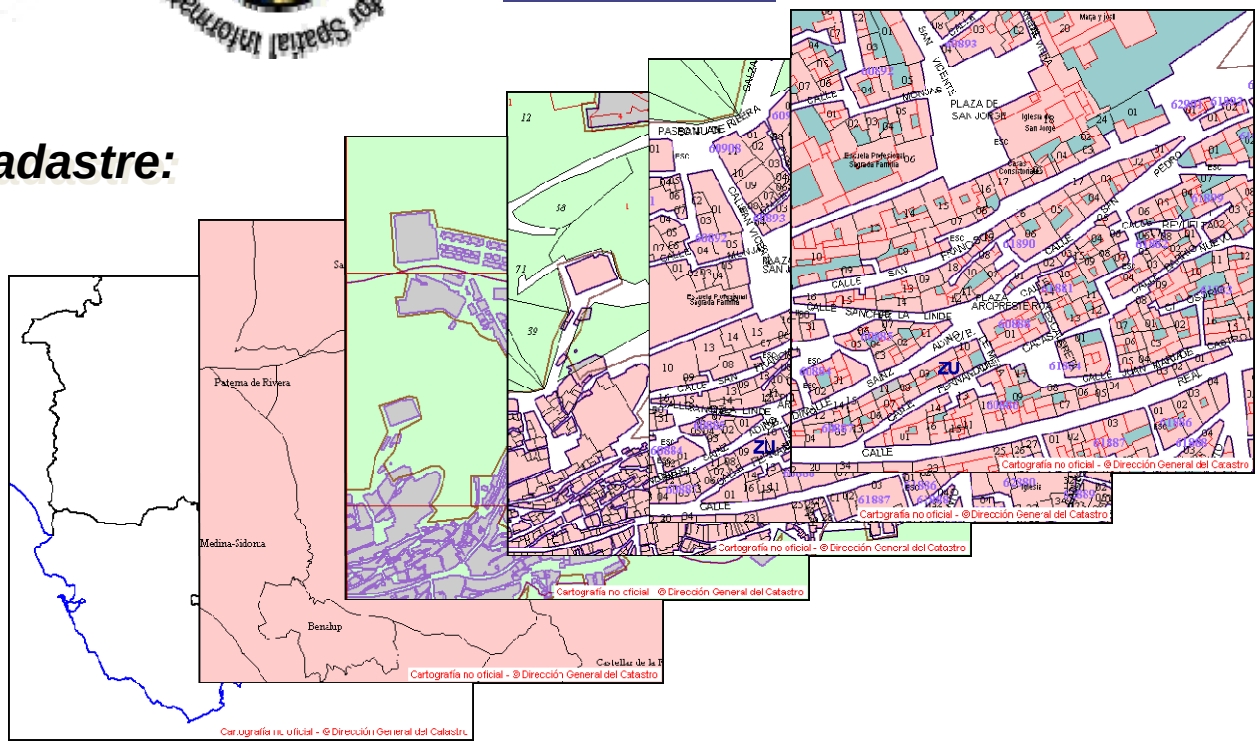
This approach has led progressively to a huge success in demand, with more than 8 millions of acces a day and more than 5 millions of certificates issued in 2010

WMS of the Spanish Cadastre:

Free of charge

For everybody

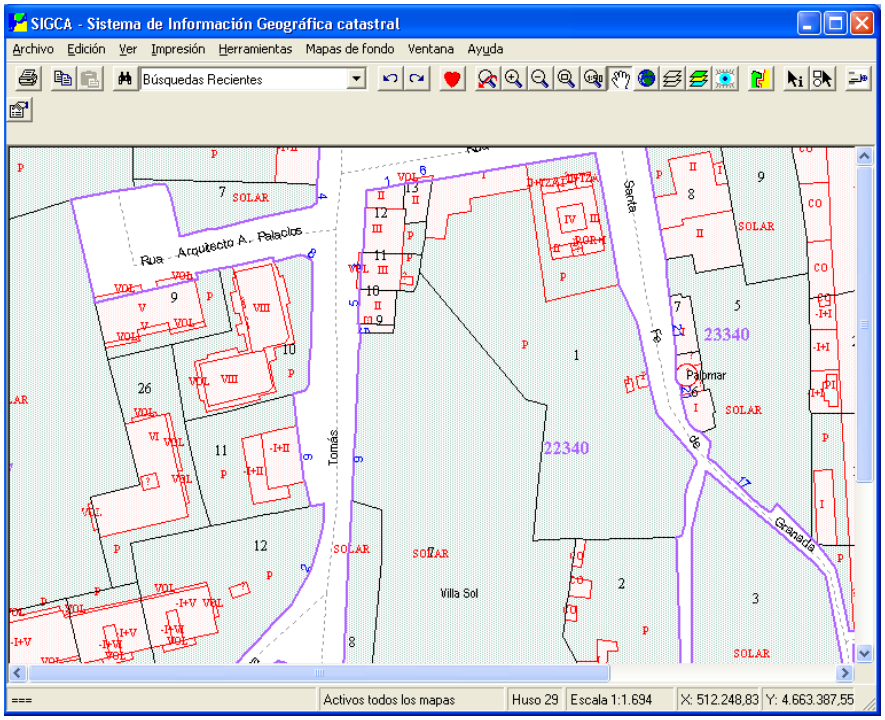
24h 7 days



http://ovc.catastro.meh.es/Cartografia/WMS/ServidorWMS.aspx

The basic layer of reference called "CADASTRE“

Its geometry is captured in 2D, without overlaps or holes.



There are other layers that can be invoked separately

Between all these layers there is a topology layer which is the so-called "CONSTRU".

geometry of the layer "CONSTRU" defines the different volumes of the buildings and other characteristics as terraces, gardens, swimming pools, etc.

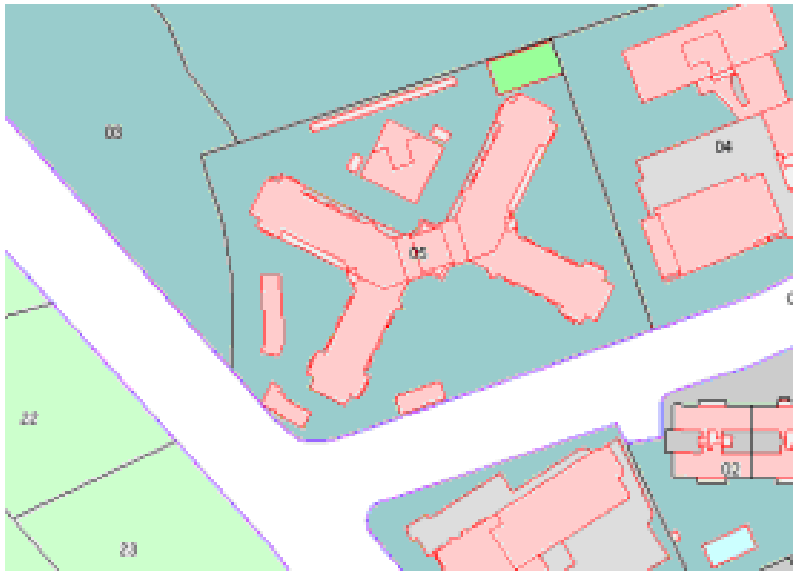
These subparcels are created

- by their nature (IP pool, JD Garden, TZA terrace,...)

-or by number of plants, for example

--I+IV basement plus four plants,

- - II+SOP+X two basements plus veranda plus ten floors,..



In the model, the texts (the numbers) that we see in the map are attributes of the construction layer CONSTRU

With all this,

How to build the 3D?

- ***WMS***
  - ***Shadow representation***
  - ***Perspective representation***

- ***3D modeling of the Cadastral cartogrphy***
  - ***3D modeling by general floor***
  - ***3D modeling by floors***

With all this,

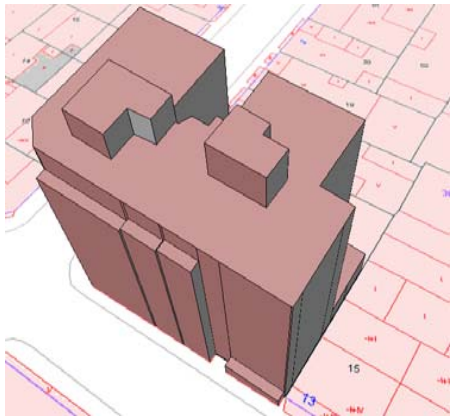
How to build the 3D?

wms catastro

***CONSTRU** layer*

The WMS service of the SDGC is developed with our own media and technology, which allow us to manipulate information obtained directly from the spatial selection of the graphic database in vector format, and to generate the resulting image of the map with the characteristics of the symbols and representations that we want to.

The CONSTRU layer is going to serve as a basis for use in the 3D representation.

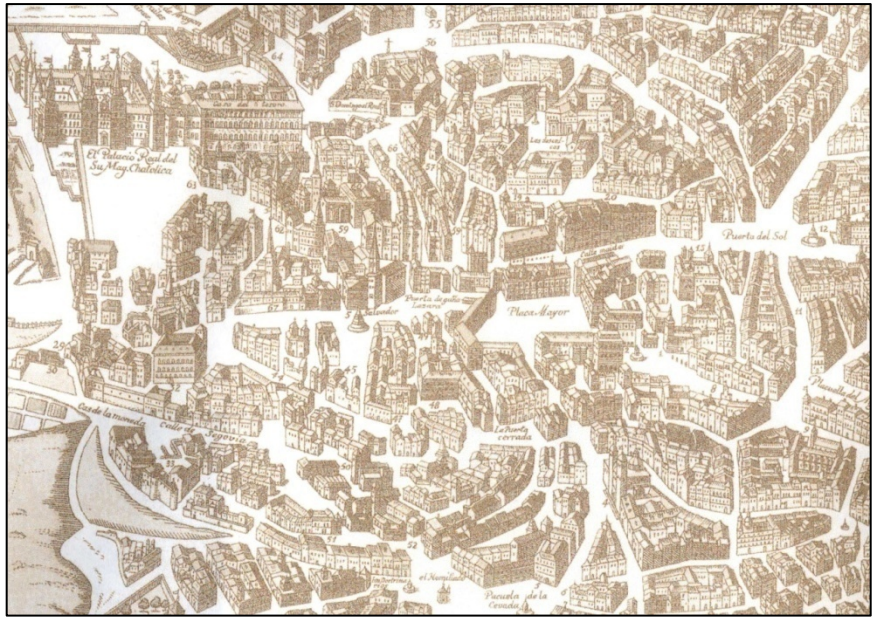


BACKGROUND

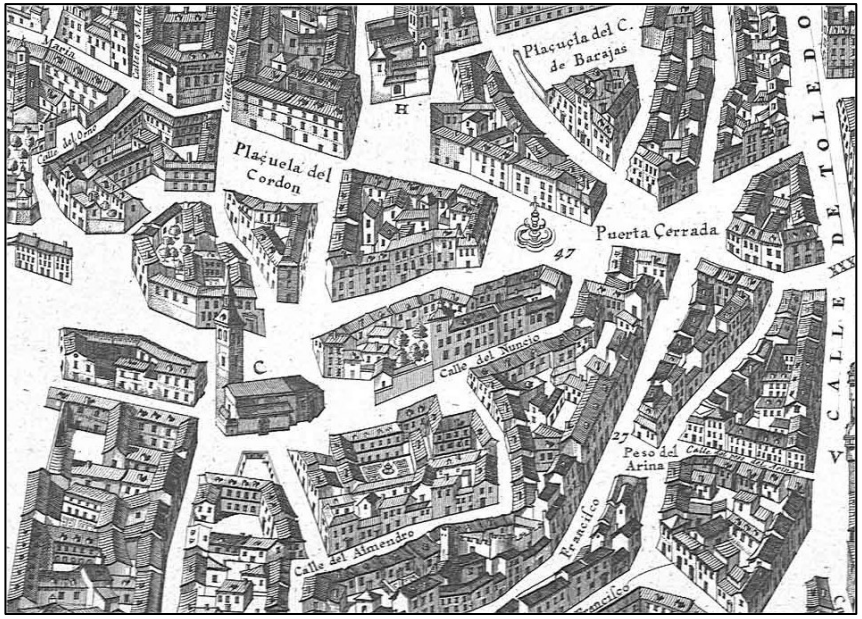
The cadastral maps and the street directories are, represented currently from a nadiral perspective: We see the city from above.

This has not always happened. In earlier times they used oblique panoramic, which represented the streets with their buildings in perspective, showing us their roofs and facades.

Siglo XVII



Villa de Madrid, Corte de los Reyes Católicos. Frederick de Wit (1635)



Mantua Carpetanorum sive Matritum Urbis Regni . Pedro de Texeira (1656)

Currently there are very significant examples where the representation used perspective to show us cities from another point of view

Siglo XXI

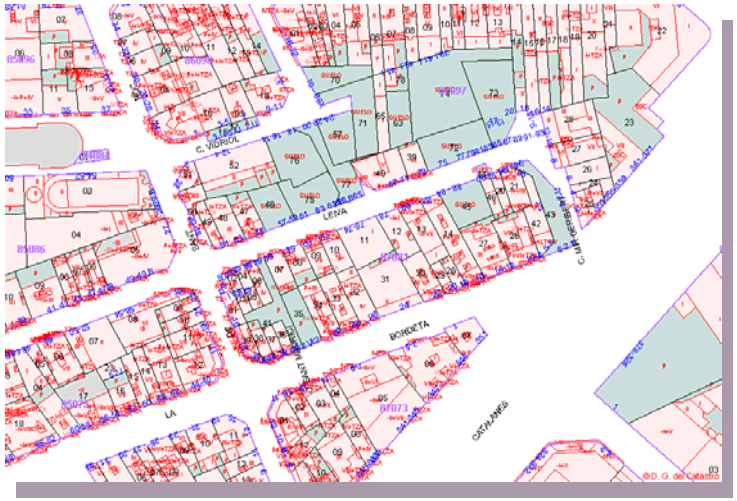
http://maps.google.es/

http: www.edushi.com

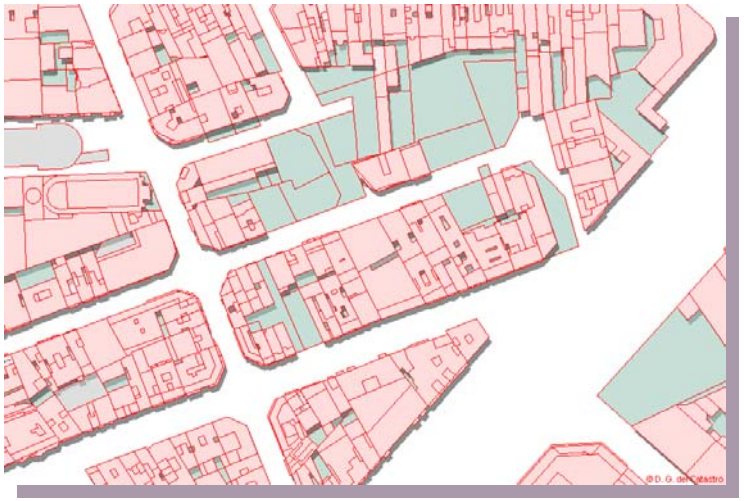
We believe that the way to see a map should allow to take advantage of the conceptualization of the old well-known cartographers and should not be very different from how they did in the past, but keeping the terms of current quality and geometric rigor.

3D REPRESENTATION IN THE WMS

We have defined two new layers in the service WMS, providing two different solutions
one using a shading to give highlight aspect to the buildings
and other that is the representation in Cavalier perspective each constructive element.



WMS Catastro



Shadow using CONSTRU3D layer

Prespective using "EDIFICIOS" "BUILDINGS" layer

Shadow using CONSTRU3D Layer

The departure information is the geometry of the "CONSTRU" layer. We first select only the sub parcels that have floors above ground level, .

The shading effect is achieved doing a shift from the geometry of these compounds in the Southeast direction drawing it semitransparent , this does not hinder the rest of the information on the map.

Then we draw the all CONSTRU layer with its own symbolism. The result is an image in which the constructions that are over the ground floor give a shadow as if they were an illumination from the Northwest.

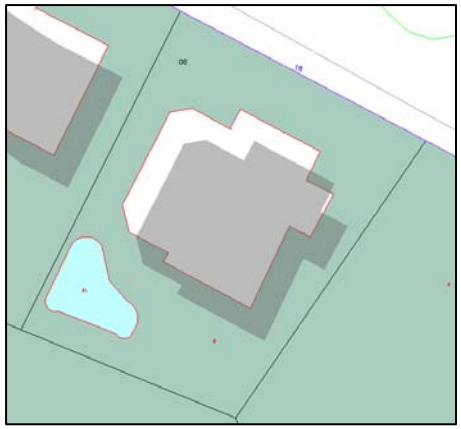
It is the visual effect that produces the feeling of relief.

Shadow using CONSTRU3D Layer

Cadastral Cartography

sub parcels that have as volumetric attribute floors above ground level

Normal representation



shift from the geometry of these compounds in the Southeast direction

semitransparent fill in grey

sub parcels that have as volumetric attribute floors above ground level
Normal representation

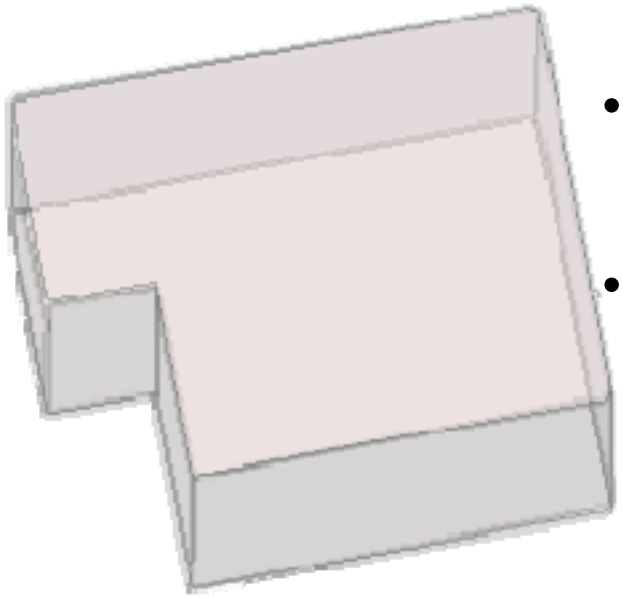
It provides a more clear vision of the fabric of the buildings in a city, and although no difference heights independently for each of the parts, but represents pretty well that three-dimensional buildings set component

Prespective using “EDIFICIOS” “BUILDINGS” layer

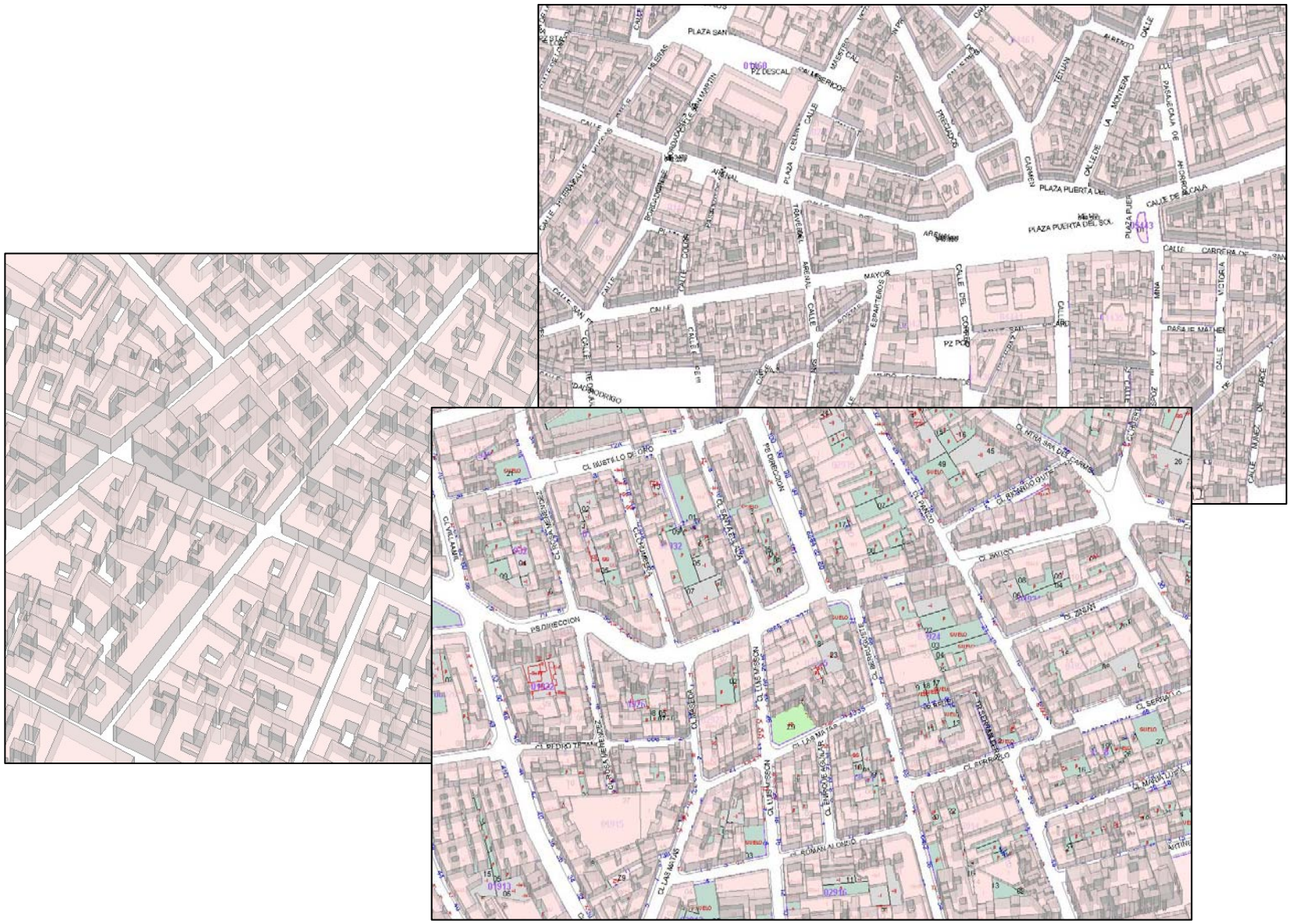
The “EDIFICIOS” (BUILDINGS) layer represents only CONSTRU layer compounds defined with buildings on ground level.

With this data we generate an image of the CONSTRU layer in Cavalier perspective, sub parcel by sub parcel, taking into account the number of floors of each object

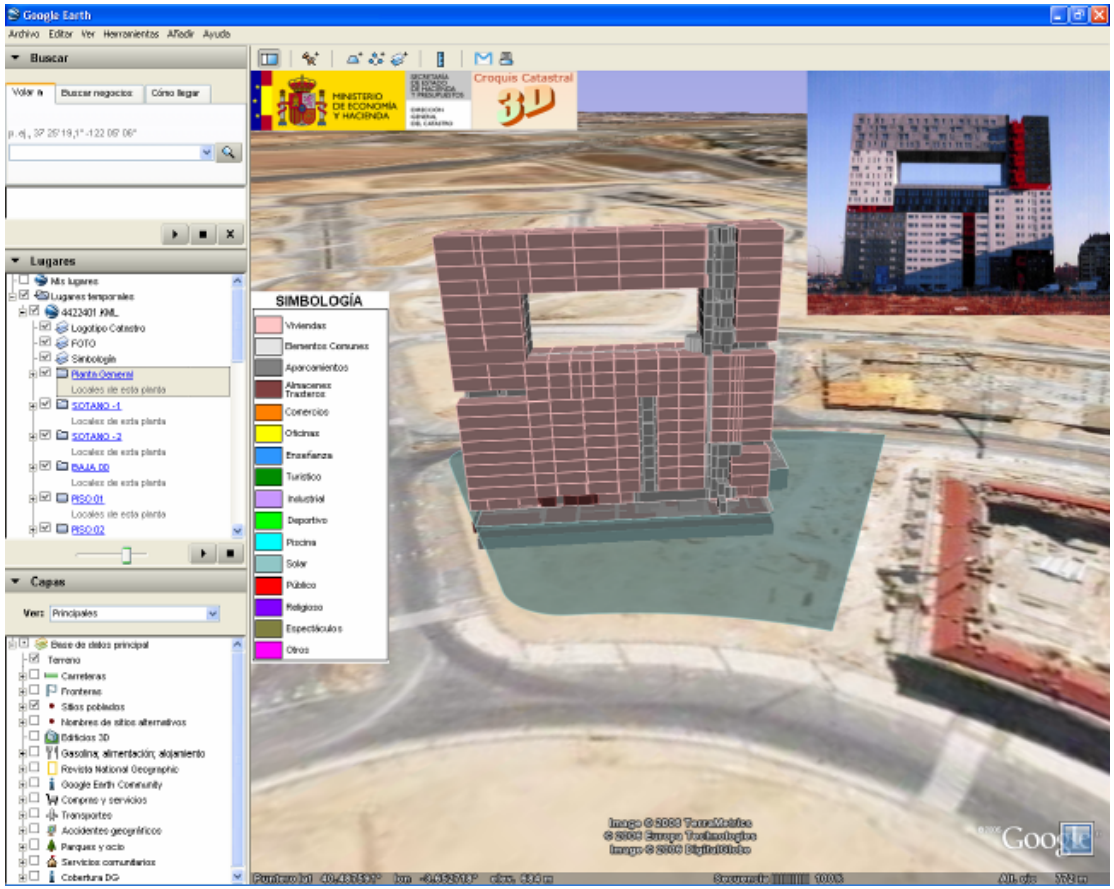
Prespective using “EDIFICIOS” “BUILDINGS” layer



- *we order the sub parcels from North to South*
- *each sub parcel is drawn in its real position with semi-transparent*
- *for each pair of consecutive coordinates that make up the sub parcel, we construct a parallelogram in the North-South direction and with different scale by a factor multiplied by the number of floors above ground level.*
- *we draw the cover of the generated prism. It is a object with the same geometry of the base but with a shift towards the North of the image, based on a factor by the number of plants*


PLAZA SAN
PZ DESCALZ
CALLE
MAYOR
PLAZA PUERTA DEL SOL
CALLE DEL CORREO
PZ DEL CORREO
CL RUSTELO DE ORO
PS DIRECCION
CL SAN MARCELINO
CL LUCHANA
CL SERRANO
CL ROMAN ALONSO
CL CLAUDIO COELLO

The SDGC has developed a vector 3D modeling by parcel in KML format.



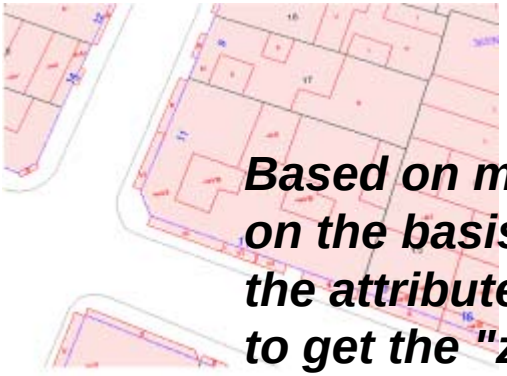
based on

-the 3D component of the constructions that it is collected as attribute of the sub parcels and

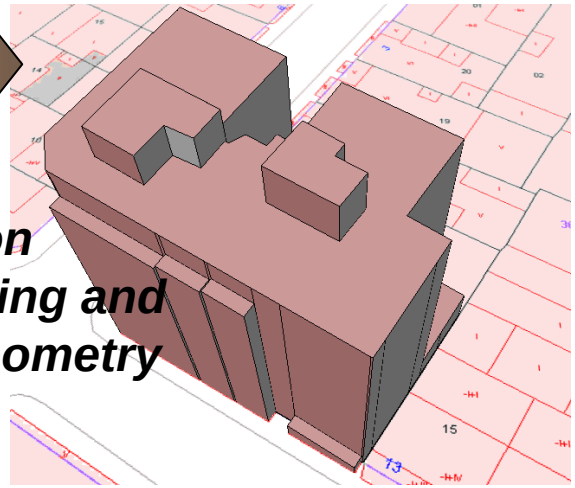
-the geometry of the premises,

This modeling is not stored in the database, it is performed in "real time" on the basis of the vector information of the geometry of objects.

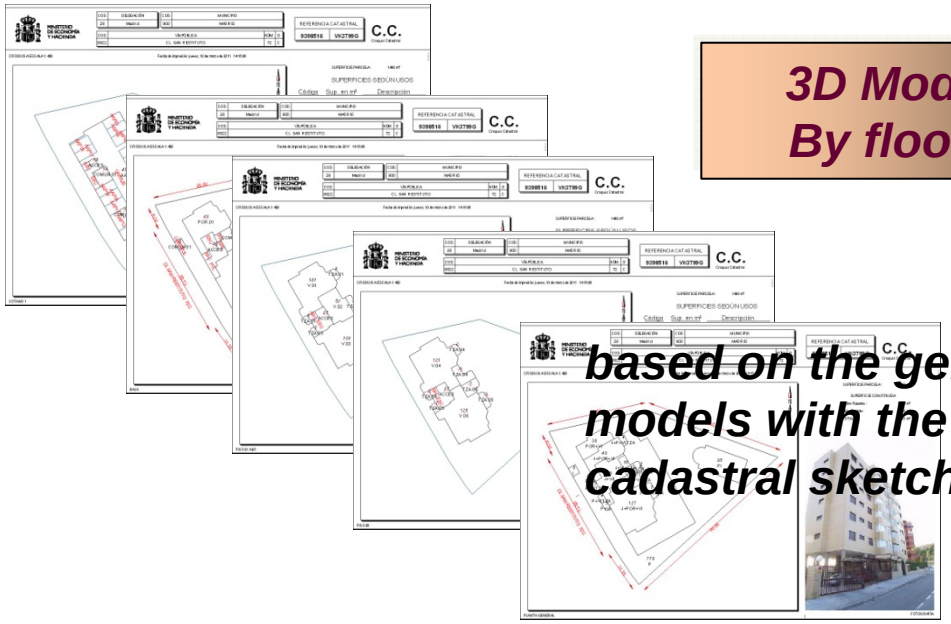
3D MODELING



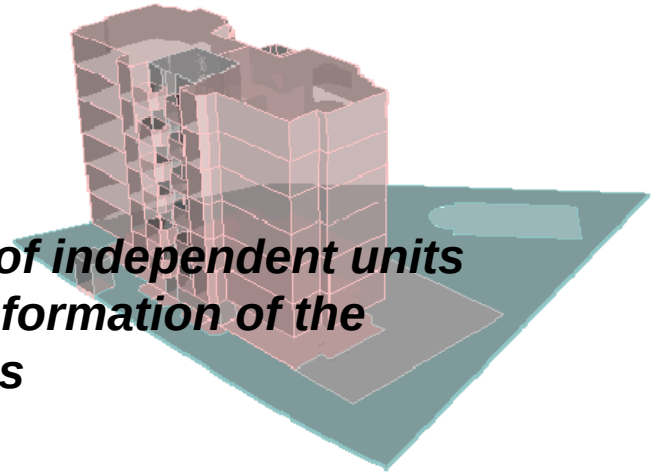
3D Model General floor



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



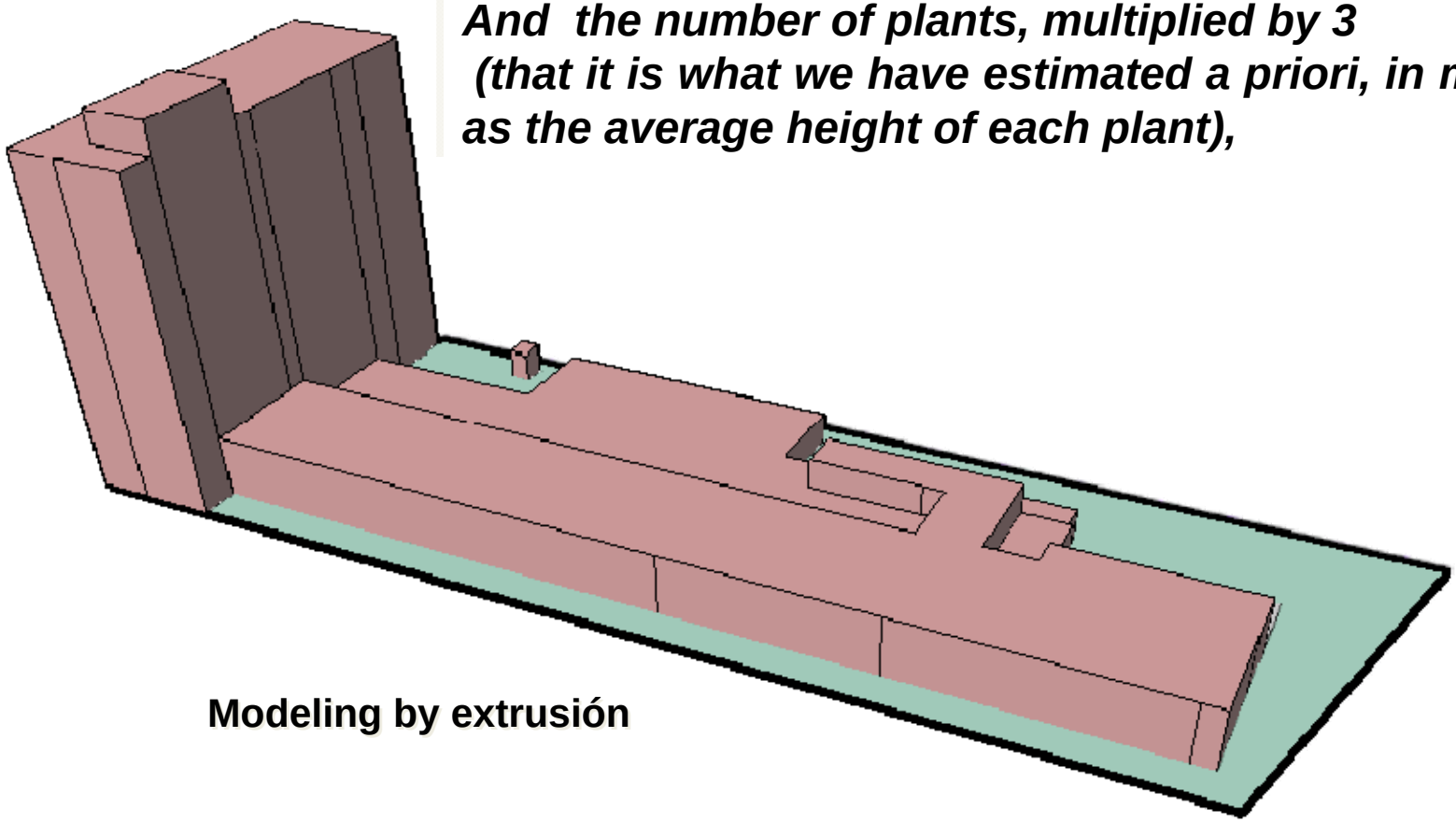
3D Model By floors



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

3D Model of General floor

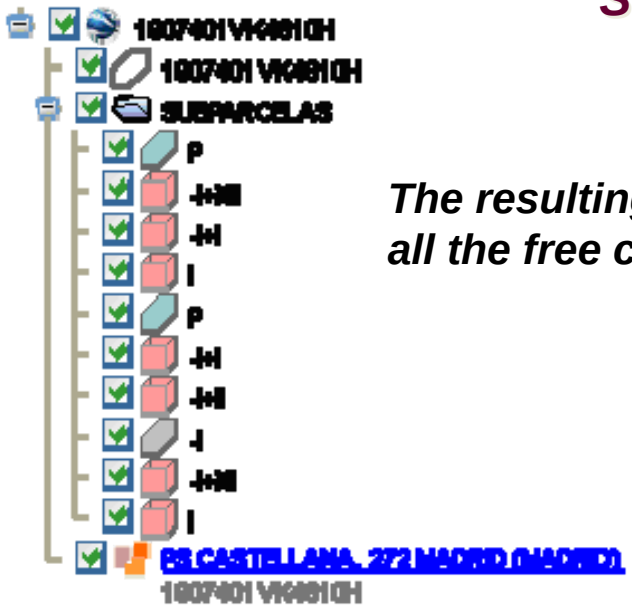
We use the cadastral cartography in vector format of each parcel.
And the number of plants, multiplied by 3 (that it is what we have estimated a priori, in meters, as the average height of each plant),



Modeling by extrusión

a 3D model by extrusion is generated for each sub parcel of the parcel.

Structure of KML File of 3D Model of general floor

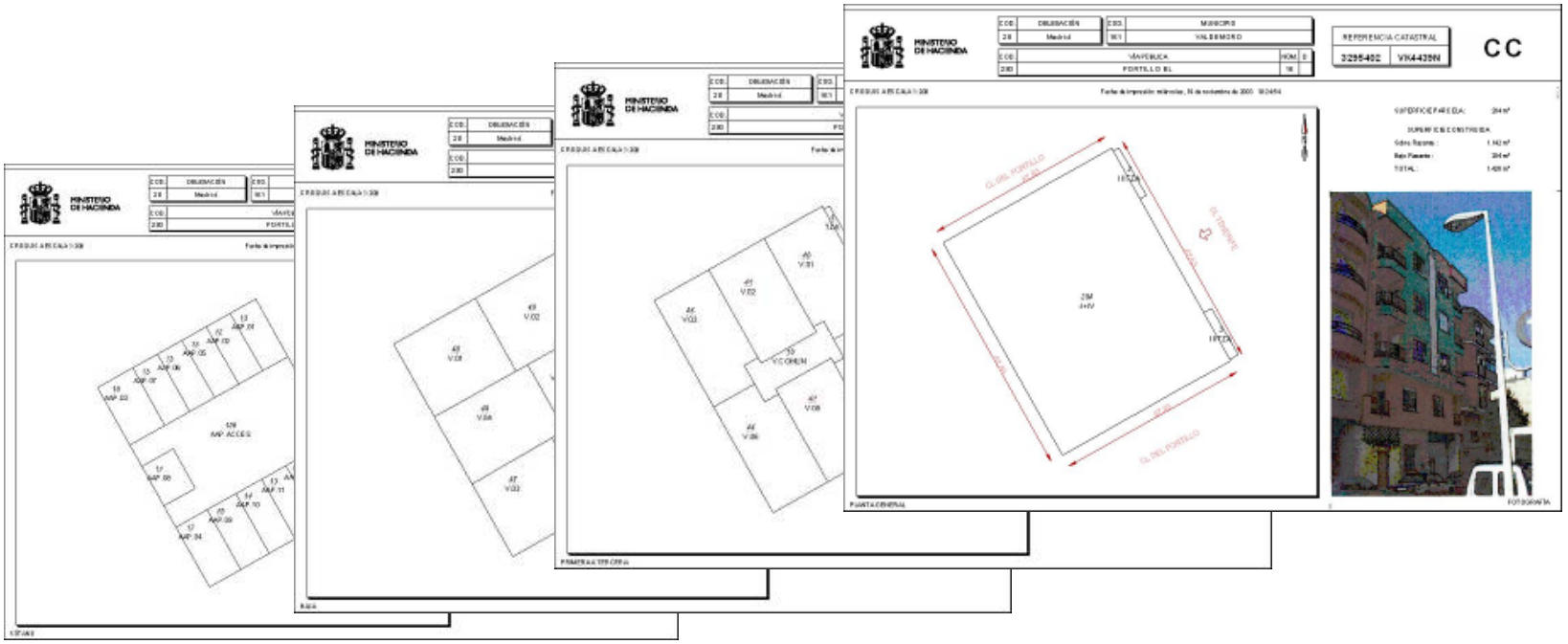


The resulting KML has a link with the cadastral reference to get all the free cadastral data of the parcel http://catastro.meh.es

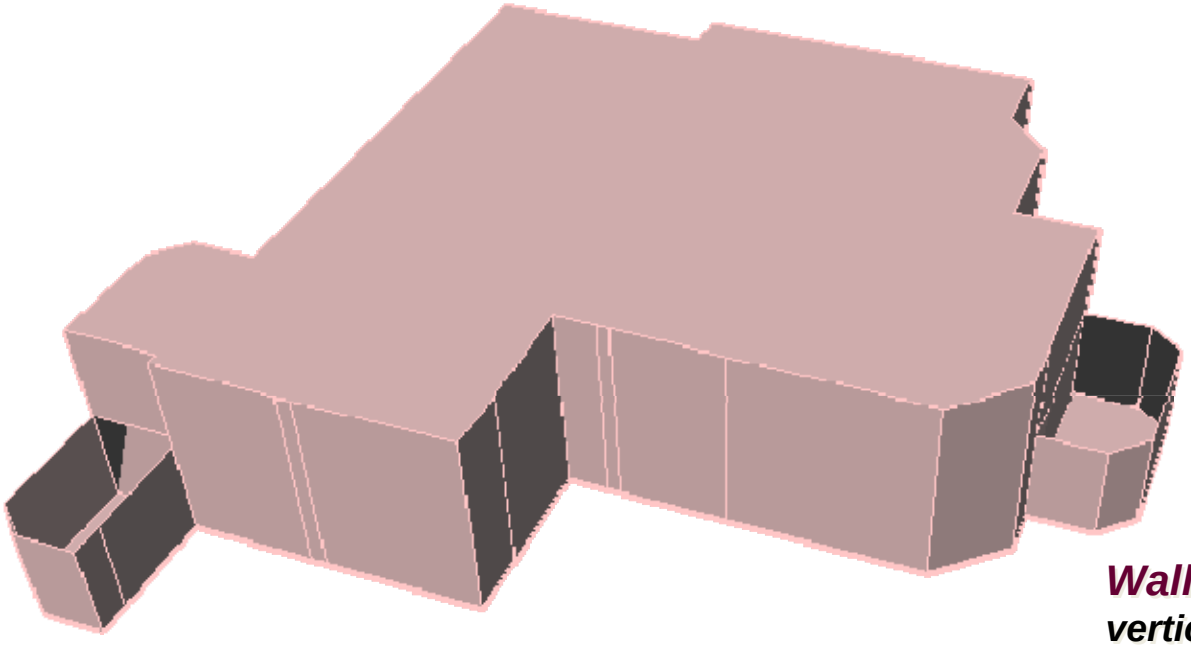
hiperlink

3D MODEL by floor

We use the information of the FXCC



Each part of the building can be then geometrically represented in three dimensions within the physical space in the building.



Roof: ***horizontal plane geometry of the local 3 metres above the ground***

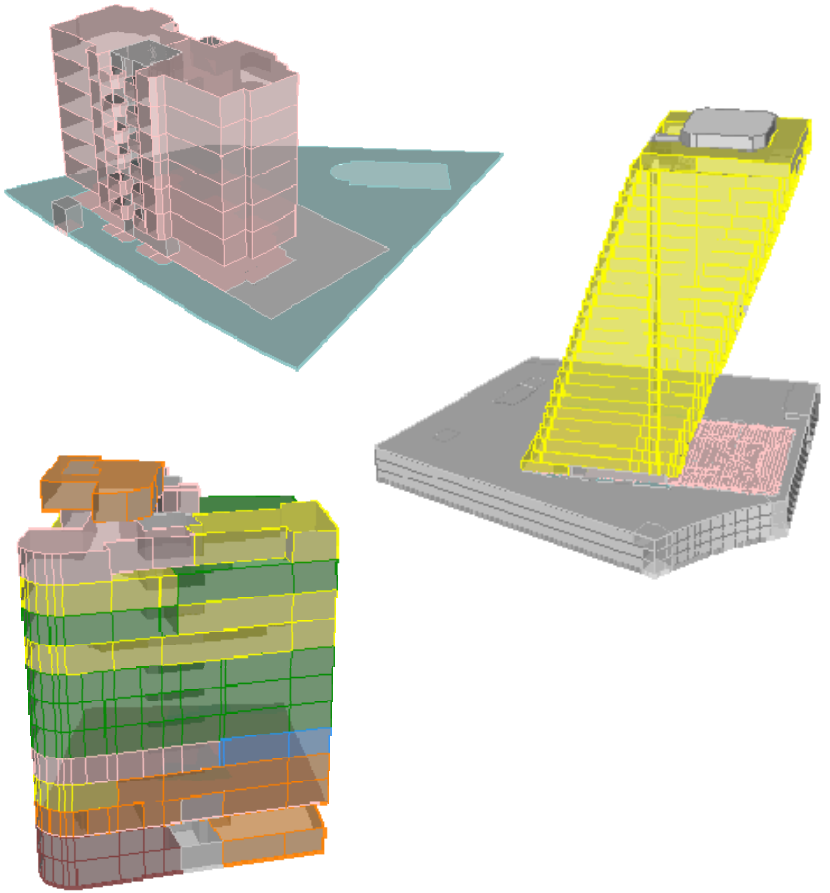
Walls: ***as rectangular vertical planes of 3 meters in height of each pair of coordinates***

Soil: ***horizontal plane geometry 2D surface***

There are some exceptions ,

For example in the case of the terraces the objects are defined by a floor and walls of 1.5 meters in height.

Even, we can give to each unit a color depending on its use, owner, value o any attribute



The structure of the resulting KML file of 3D modelling by floor

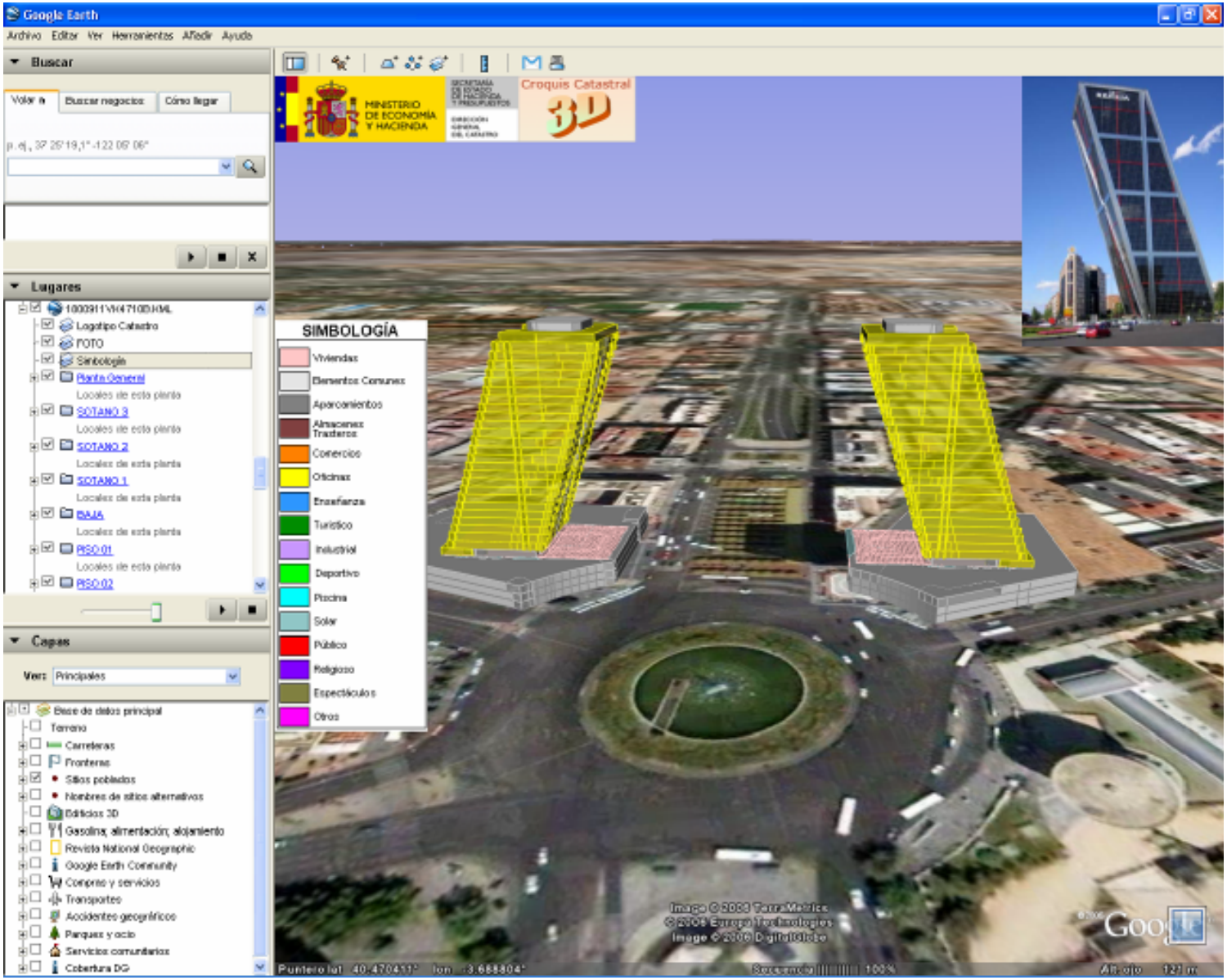
We organize by folder each plant, and sorted by position, and in them there is the content of the geometry of the premises as separate units. This allows seeing every floor separately

- Logo
- Simbol
- Position mark with hiperlink to our OVC
- General floor

  - Premisses of the general floor with their atributes of number of pants

- *Every floor*

  -Premisses of everyfloor


Google Earth
Archivo Editar Ver Herramientas Añadir Ayuda
Buscar
Volar a
Buscar negocios
Cómo llegar
Lugares
Capas
Ver: Principales
MINISTERIO DE ECONOMÍA Y HACIENDA
Croquis Catastral
3D
SIMBOLOGÍA
Viviendas
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Almacenes Trasteros
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Turístico
Industrial
Deportivo
Piscina
Solar
Público
Religioso
Espectáculos
Otros
Base de datos principal
Terreno
Carreteras
Fronteras
Sitios poblados
Nombres de sitios alternativos
Edificios 3D
Gasolina, alimentación, alojamiento
Revista National Geographic
Google Earth Community
Compras y servicios
Transportes
Accidentes geográficos
Parques y ocio
Servicios comunitarios
Cobertura DG

API Google Earth in our virtual office

Cartogrphy 3D

API Google Earth

3D by floor

API Google Earth in our virtual office

3D by floor

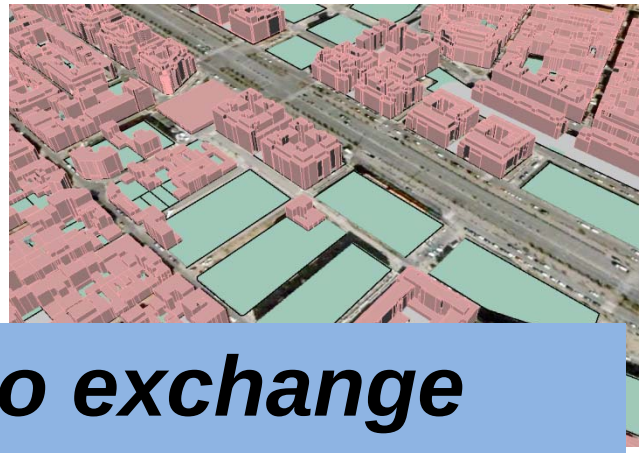
We can see every floor of the building in 3D

Catastro 4D

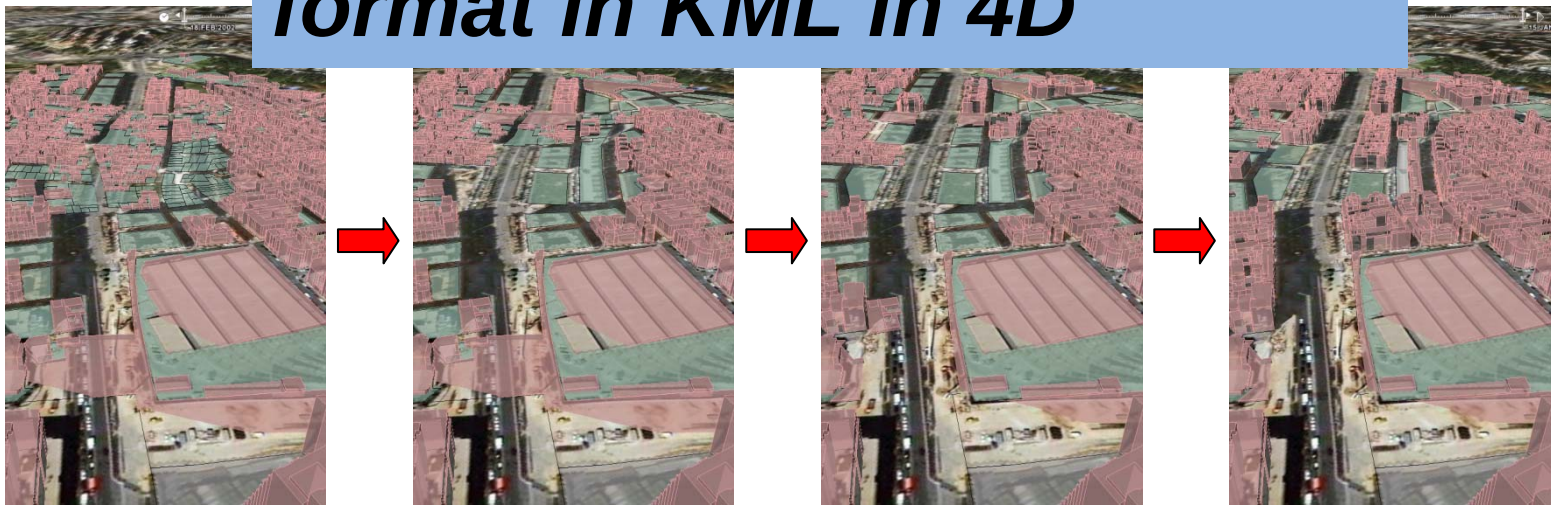
Time

2002

2008



We offer also exchange format in KML in 4D



CONCLUSIONES

- ***The cartography of the Spanish cadastre can by modeling in 3D .***

- ***the idea of representing 3D objects in services WMS, is a novelty for us and provides a better interpretation of the city***

- ***Modelling 3D automatically based on simple schemes that allows to reconstruct a large amount of data, offers a good solution to the demand for such products, increasingly requested by users.***

- ***We don't need complicate representations with textures etc....we need something simple and useful!!!!***

- Some examples

Our main office
https://ovc.catastro.meh.es/cartografia/wms/buscarparcelagoogle3d.aspx?refcat=1907401VK4810H&tipo=3d

This last example:

https://www.sedecatastro.gob.es/cartografia/fxcc/fxcc_kml.aspx?refcat=4422401VK4482D


Thank you for your atention