



Creation of the Consensus Model for Spain of INSPIRE Building data



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The Inspire Buildings model, to fulfill most of user requirements, includes **both**:

- *basic **topographic** data (such as real height, nature of buildings, shape ...)*
- *and **cadastral official data** (such as current use, number of dwellings or of building units);*





In Spain **coexist** several databases related to the theme Buildings.



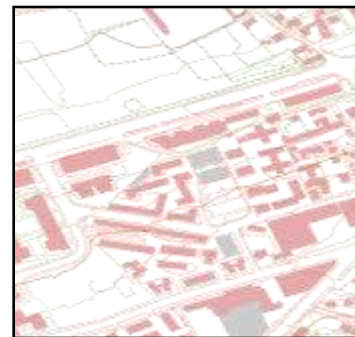
cadastral datasets scales generally larger or equal to 1: 2000. 2D (even if is possible to build 3D)



And **topographic dataset** from regional and local administrations (2D, 2,5D and in some cases even 3D) at scales around 1/ 10 000



Cataluña



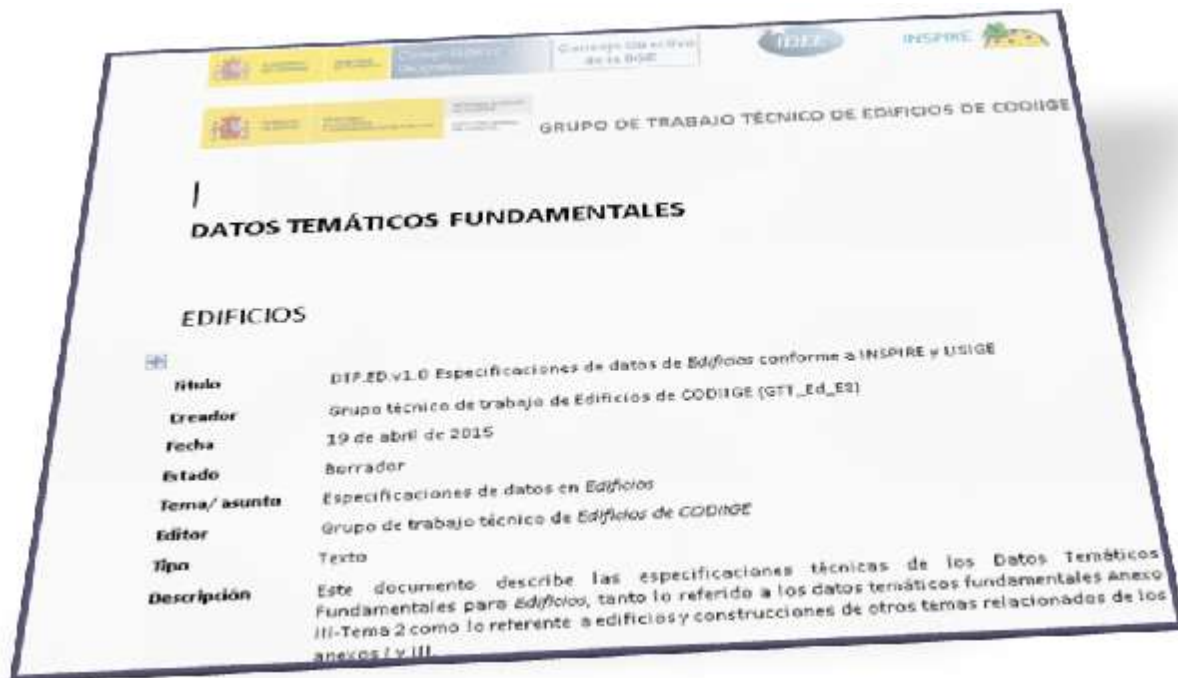
Cantabria



Canarias



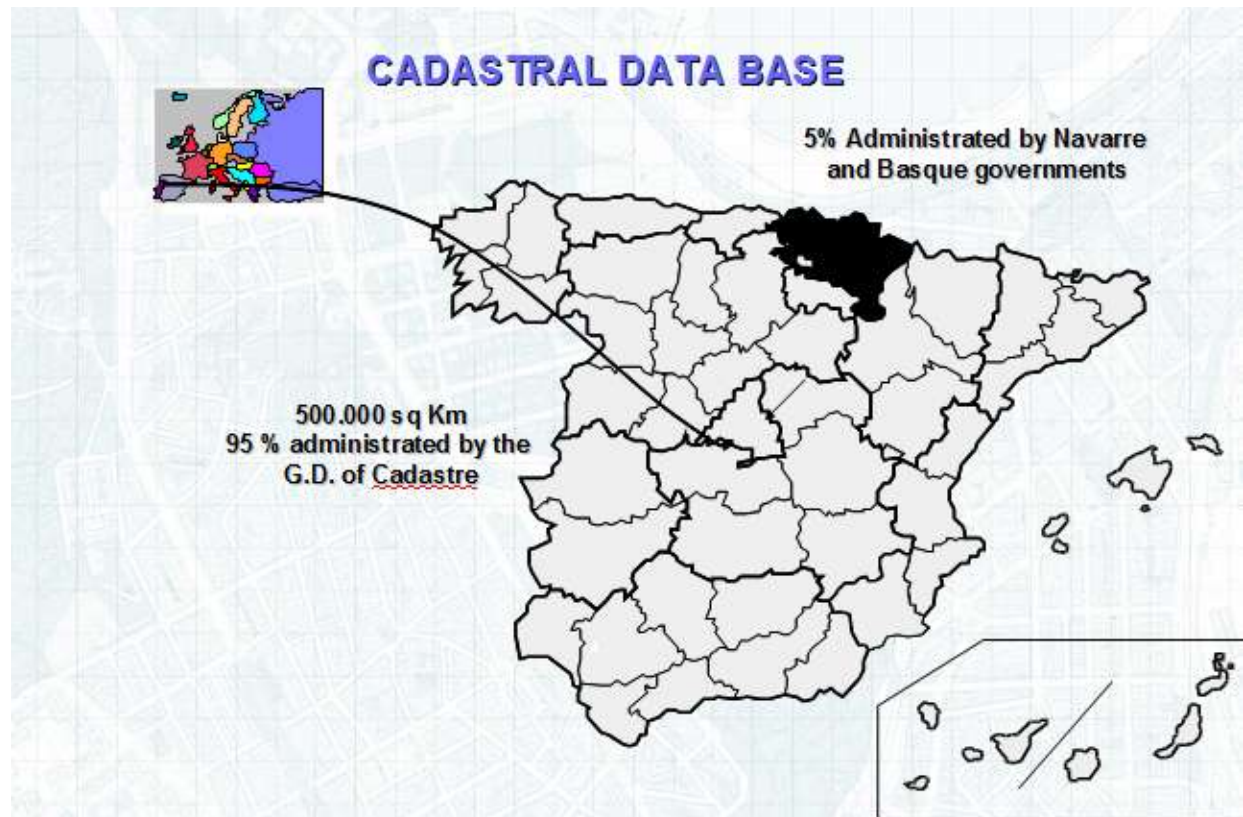
During the years 2014 -2015 the buildings data producers of both cadastral and topographic, from different levels of administration: national, regional and local, have been working to reach a consensus on the Spanish data model of buildings for INSPIRE



At cadastral level:

- **95%** of the Spanish Territory is cover by the General Directorate for cadastre (SDGC)
- The rest **5%** is cover by the Bask land and Navarra´s cadastres.

5 cadastral data set in total.





At topographic level it is much more complicated because there are many different datasets, regional, local, and thematic, with different information, scales ect...and, 2D 2,5 D and in some cases 3D

Some Problems:

*17 regions
56 provinces
8000 municipalities*

- Information mixed with other topographic information*
- In many cases information is not complete for the total territory.*
- The range of scales is varied*
- The distribution of information by layers is also very varied*



INSPIRE Infrastructure for Spatial Information in Europe

D2.8.III.2 Data Specification on *Buildings* – Technical Guidelines

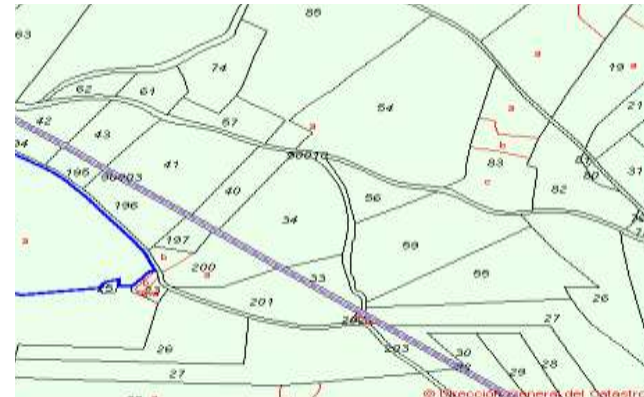
Title	D2.8.III.2 INSPIRE Data Specification on <i>Buildings</i> – Technical Guidelines
Creator	INSPIRE Thematic Working Group <i>Buildings</i>
Date	2013-12-10
Subject	INSPIRE Data Specification for the spatial data theme <i>Buildings</i>
Publisher	European Commission Joint Research Centre
Type	Text
Description	This document describes the INSPIRE Data Specification for the spatial data theme <i>Buildings</i>
Contributor	Members of the INSPIRE Thematic Working Group <i>Buildings</i>
Format	Portable Document Format (pdf)
Source	

-How transform these data to INSPIRE model?

We decided to take as basis the national cadastre

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

*This description includes **physical, legal and economic characteristics**, location, cadastral reference, address, areas, uses, class of crop, buildings, time attributes, cadastral value 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.



The Spanish cadastre has information of

- 12.5 million urban parcels,***
- 34 million urban units and***
- 40 million rural parcels***

in a continuous and uniform model





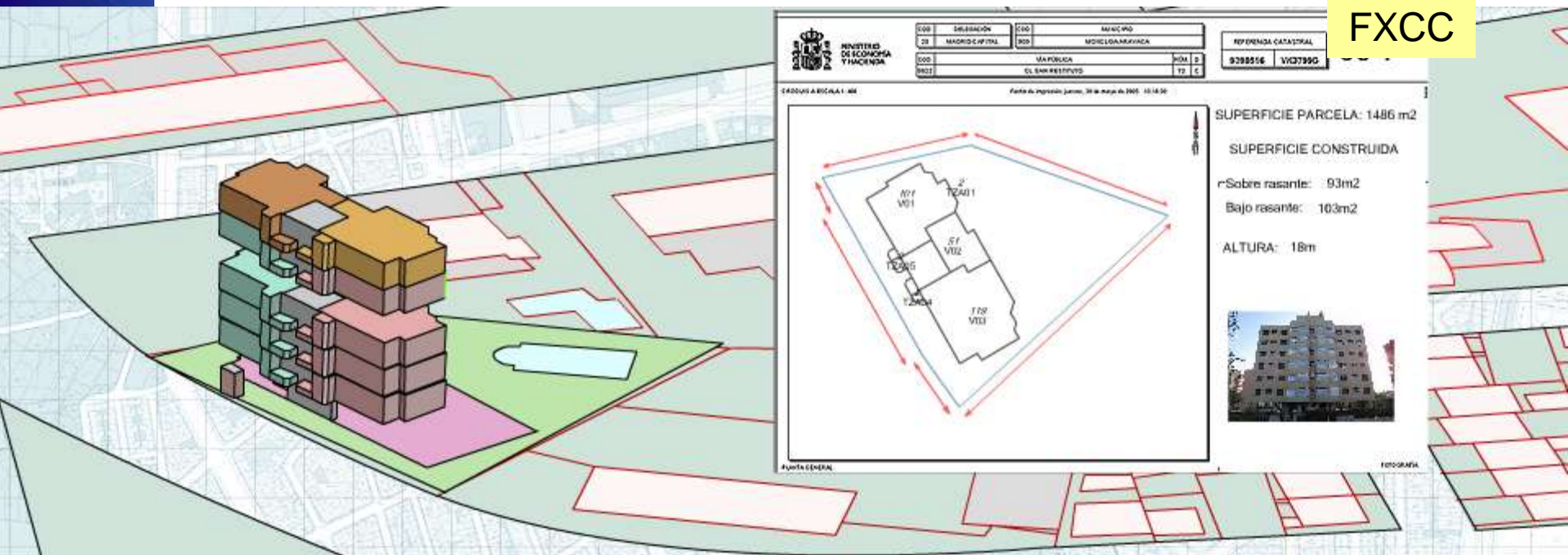
The cadastral value for each property is determined objectively from the data in the Real Estate Cadastre.



Interesting data for INSPIRE buildings

Physical data of real estate:
*land surface,
buildings surface,
conservation status,
use (legal and actual one),
typology,
year of construction.....*

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



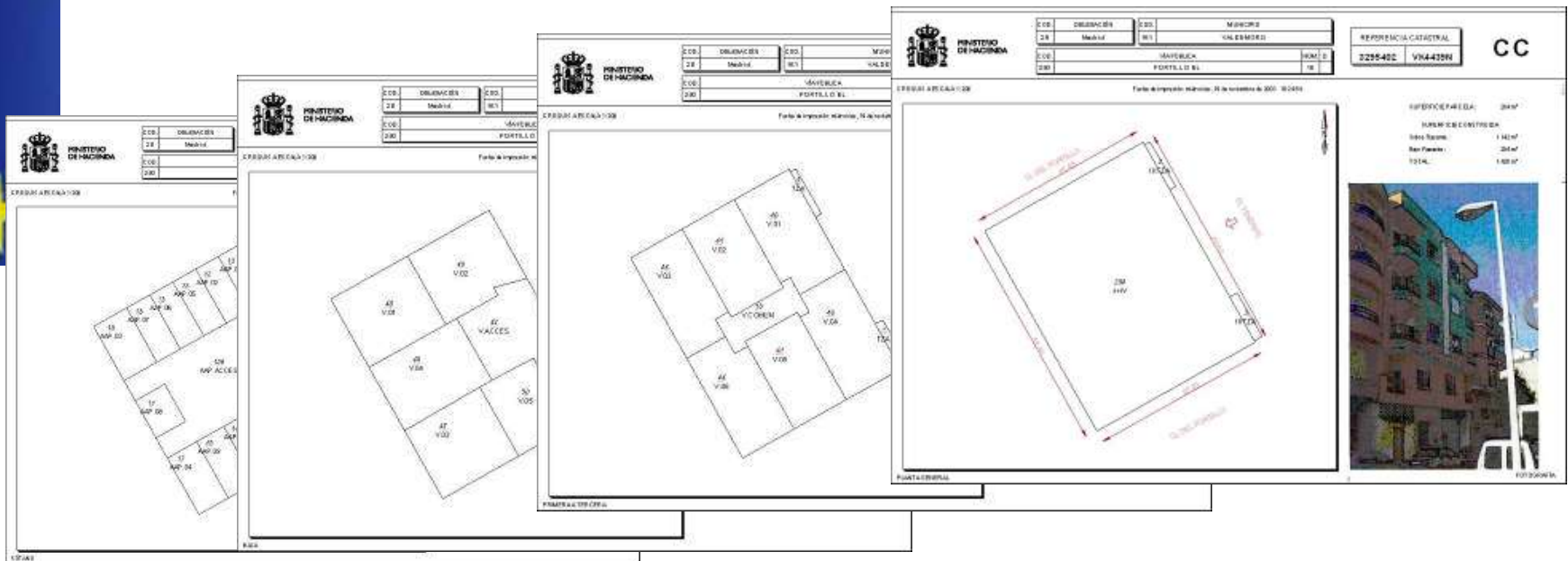
FXCC

For every building the database contains a sketched floor plan in digital form, the FXCC (Format eXchange for Cadastral Constructions)

The FXCC document is a scaled graphic representation of the properties forming an urban real estate building.

The different floor plans and interior spaces are represented

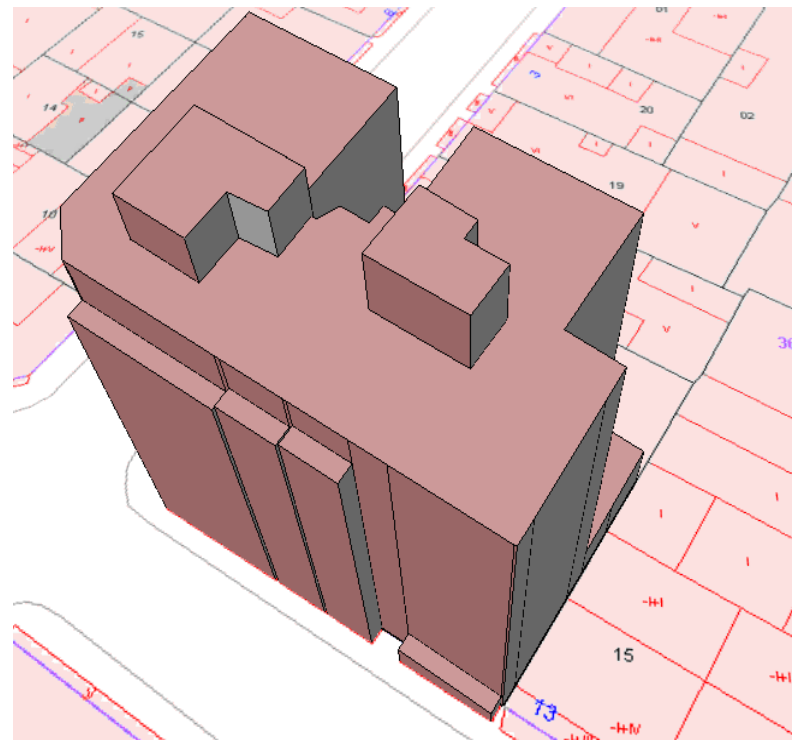
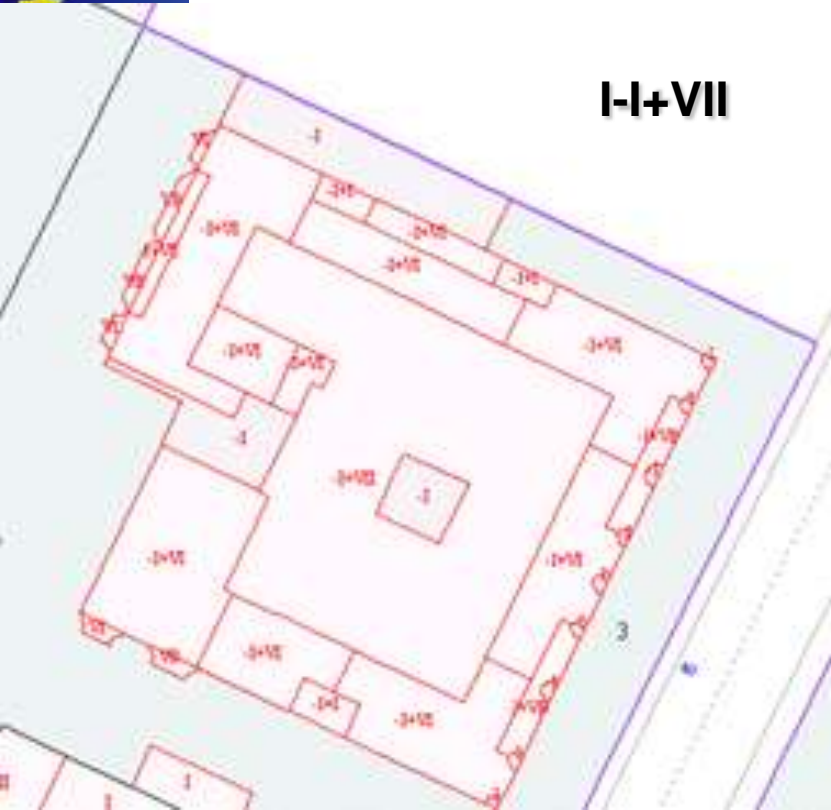
The FXCC contains a digital photo of the building too and it is storage in the data base parcel by parcel.



How we represented all these information in the index map?

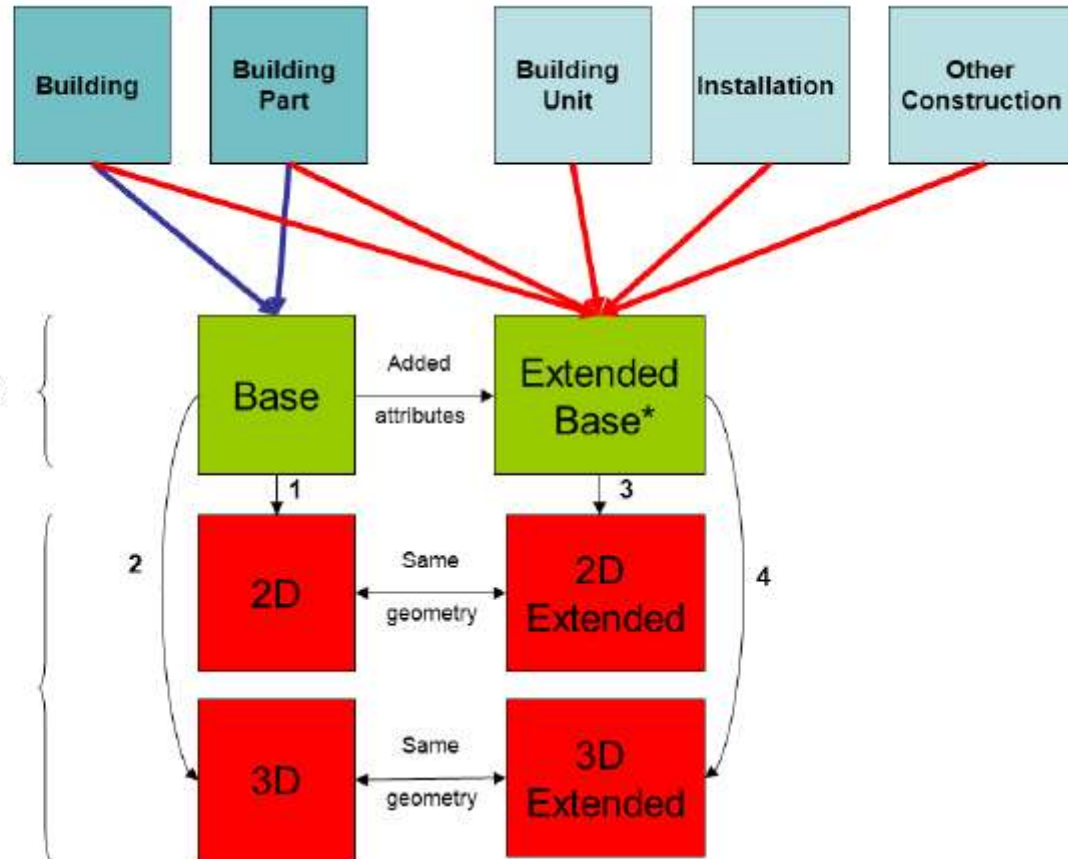
Cadastral cartography, even in only 2D, has the **volumetric information** of the buildings and buildings parts by number of plants in roman numerals in their maps.

I-I+VII





Main feature types



Alternative deliveries:

- 1 = simple semantics + 2D geometry
- 2 = simple semantics + 3D geometry
- 3 = extended semantics + 2D geometry
- 4 = extended semantics + 3D geometry + additional 3D feature types

*Includes Building Base

Figure 3: Content and structure of application schemas for theme Buildings

Feature types are represented in blue. Abstract application schemas are represented in green. Instanciable application schemas are represented in red.

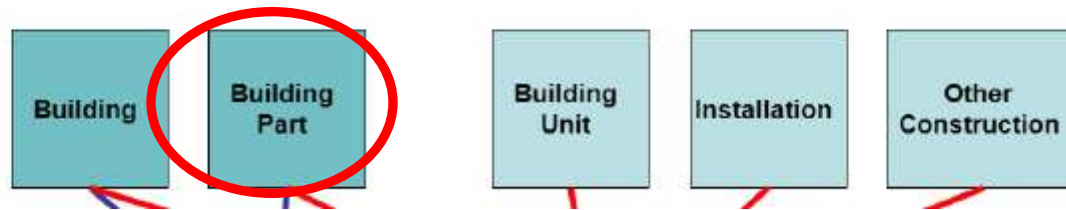
Main feature types



What we consider buildings?

- A wide definition including buildings and constructions
 - Considered as under scope of the theme Buildings are constructions above and/or underground which are **intended or used** for the shelter of humans, animals, things, the production of economic goods or the **delivery of services** and that refer to any structure permanently constructed or erected on its site.

Main feature types



One Building with 2 BuildingParts

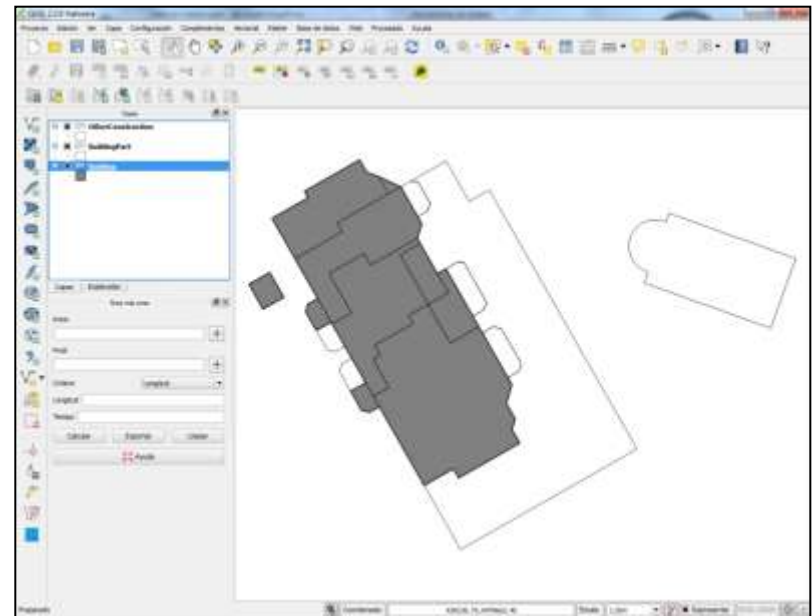
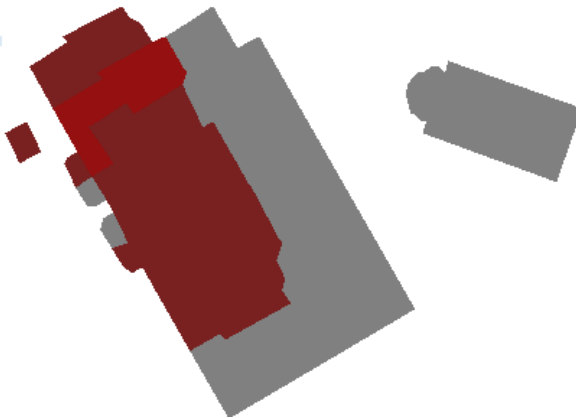


Figure n°1 : From City GML

A BuildingPart is a sub-division of a Building that might have been considered as a building and that is homogeneous related to its physical, functional or temporal aspects. It is up to each data producer to define what is considered as a Building and what is considered as a BuildingPart.

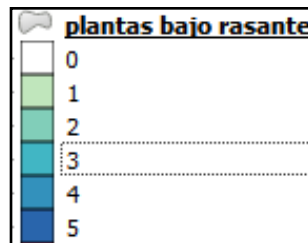


- We have "to build" the building from the buildings parts.
- **Multirecint** defined by the envelope line of all constructions with volume above ground of each parcel



*In this way we will have information about the **building parts**, for example number of floors under the ground, but in the indexmap we will see only the over ground part*

Nº floors under the ground



Unfortunately we can not provide by now the buildingunit feature in the way that has been defined in INSPIRE

○ We need also to create an identifier

4.2.1.4. Identifier management

The buildings and building parts have to be identified by the mandatory attribute inspireID; this unique identification enables the buildings and building parts to be target of associations from other INSPIRE themes, e.g. from theme Address.

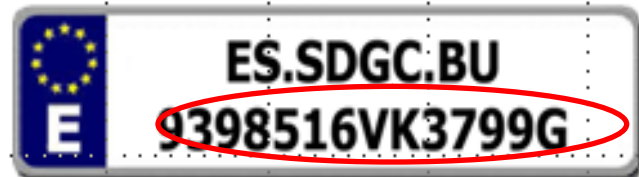
namespace: country, data provider organization, thema
localID: cadastral reference of the parcel

Building

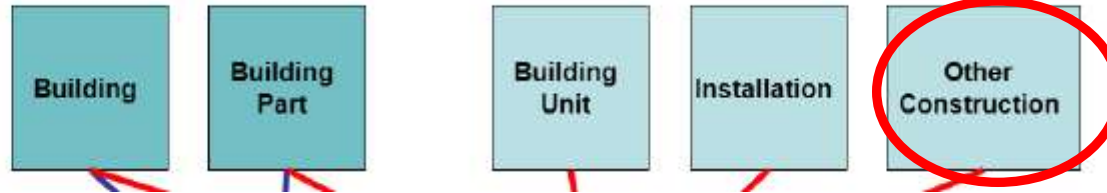
```
<bu-ext2id:Building gml:id="ES:SDGC.BU.9398516VK3799G">
```

boundedBy





















```
<gml:boundedBy>
<gml:Envelope srsName="urn:ogc:def:crs:EPSG::25830">
<gml:lowerCorner>439222.47 4479637.48</gml:lowerCorner>
<gml:upperCorner>439283.23 4479687.38</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
```



Main feature types



Scope of theme Building has been enlarged to include feature type OtherConstruction (e.g. bridges, environmental barriers, elevated constructions)

				
acousticFence	antenna	chimney	bridge	bridge
				
cityWall	crane	monument	monument	monument
				
monument	monument	openAirPool	protectiveStructure	protectiveStructure
				
pylon	retainingWall	solarPanel	substation	tunnel

Illustrations of other constructions

OtherConstructions are self-standing constructions that are generally not considered as buildings. This extended profile includes the most significant constructions that are necessary to describe landscape and to fulfil use cases such as safety or spatial planning.

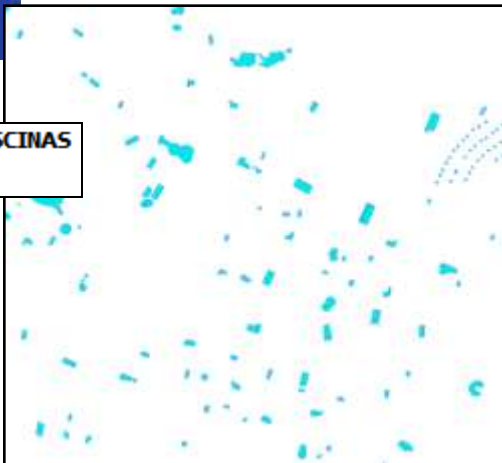


OtherConstruction

«codeList» OtherConstructionNatureValue
+ acousticFence
+ antenna
+ bridge
+ chimney
+ cityWall
+ crane
+ monument
+ openAirPool
+ protectiveStructure
+ pylon
+ retainingWall
+ solarPanel
+ substation
+ tunnel

It is a topographical point of view, very different from cadastral point of view

**Spanish Cadastre
 Only considers
 Openairpool as
 “otherconstruction”**



<bu-ext2d:OtherConstruction
 gml:id="ES.SDGC.BU.9398516VK3799G_PI.1">

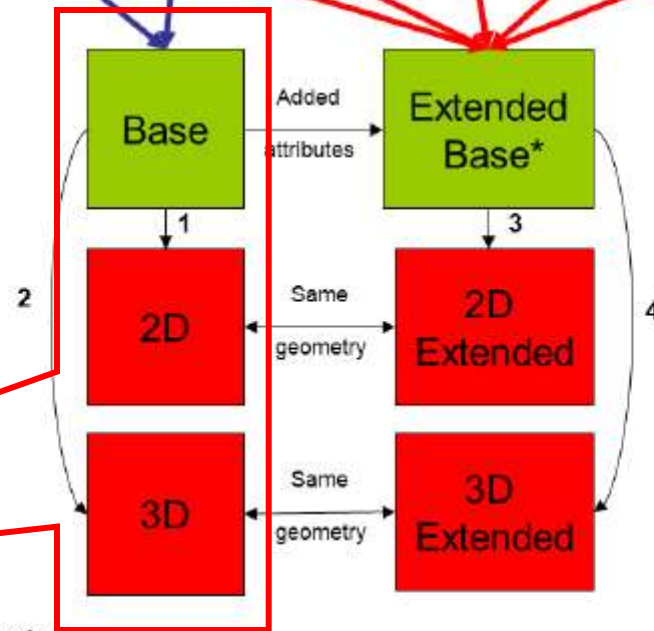
<bu-ext2d:constructionNature>openAirPool</bu-ext2d:constructionNature>

Main feature types



Semantics

Geometry



Alternative deliveries:

- 1 = simple semantics + 2D geometry
- 2 = simple semantics + 3D geometry
- 3 = extended semantics + 2D geometry
- 4 = extended semantics + 3D geometry + additional 3D feature types

*Includes Building Base

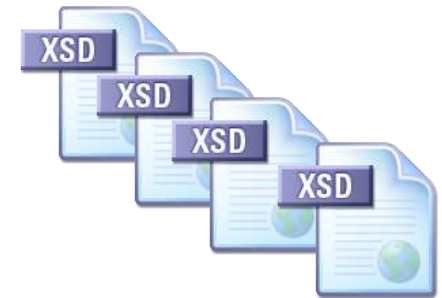
IR

Figure 3: Content and structure of application schemas for theme Buildings

Feature types are represented in blue. Abstract application schemas are represented in green. Instanciable application schemas are represented in red.

schemes XSD for Buildings:

- BuildingCore2D.xsd
- BuildingCore3D.xsd
- BuildingExtended2D.xsd
- BuildingExtended3D.xsd



BuildingExtended2D

*Core data is not enough for us because there are attributes as **number of floors below ground** , **values of properties** etc... that are important in cadastre .*

*And **other constructions** are important for topographic users*

Main feature types



*The main feature is **BU.Building** that contains attributes relating to conservation status, uses, dates of construction, number of units, number of dwellings, external reference to cadastral data and photographs of facade,...*

BU:BuildingPart

Contains number attributes of plants and estimated heights, on and below the ground level.

BU.OtherConstruction

In the case of the cadastral maps we can only provide the geometry and surface of openairpool

Regional geographical institutes and local organization have much more information about this feature

ExternalReference



- *We offer in the model of INSPIRE very few data regarding those that we would have been able to provide.*
- *But we provide the **national cadastral reference** and a **link** to access to all the Cadastral Information*

The core2D profile offers one option to link a spatial object (building or building part) defined in INSPIRE to information in other systems: the attribute externalReference provides the identifier/reference of the object in that foreign system together with the name and the URL of that



<https://www1.sedecatastro.gob.es/CYCBienInmueble/OVCListaBienes.aspx?rc1=0299305&rc2=YH5700S>

Temporal attributes



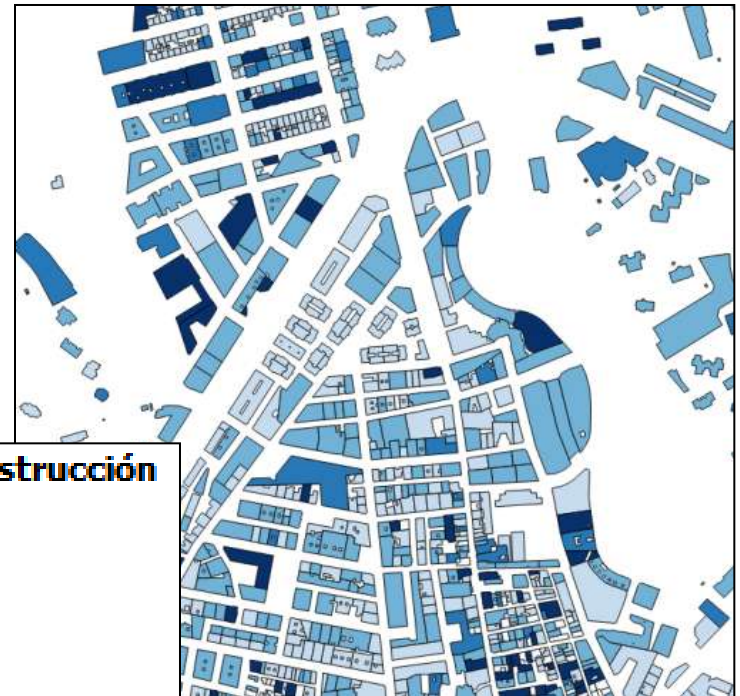
beginLifespanVersion

`<bu-core2d:beginLifespanVersion>2005-11-21T00:00:00</bu-core2d:beginLifespanVersion>`

endLifespanVersion

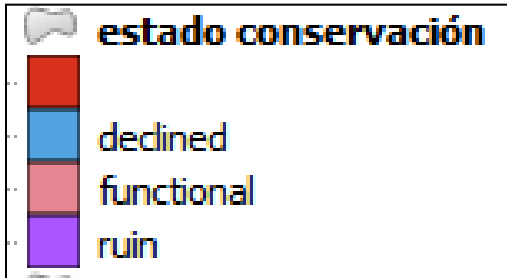
dateOfConstruction

`<bu-core2d:dateOfConstruction>`
`<bu-core2d:DateOfEvent>`
`<bu-core2d:anyPoint>1997</bu-core2d:anyPoint>`
`</bu-core2d:DateOfEvent>`
`</bu-core2d:dateOfConstruction>`



conditionOfConstruction

<bu-core2d:conditionOfConstruction>functional</bu-core2d:conditionOfConstruction>





Classifications. Code list



use

residential
individualResidence
collectiveResidence
twoDwellings
moreThanTwoDwellings
residenceForCommunities
agriculture
industrial
commerceAndServices
office
trade
publicServices
ancillary

Building nature

«codeList»
BuildingNatureValue

- + arch
- + bunker
- + canopy
- + castle
- + caveBuilding
- + chapel
- + church
- + dam
- + greenhouse
- + lighthouse
- + mosque
- + shed
- + silo
- + stadium
- + storageTank
- + synagogue
- + temple
- + tower
- + windmill
- + windTurbine

Construction nature

«codeList»
OtherConstructionNatureValue

- + acousticFence
- + antenna
- + bridge
- + chimney
- + cityWall
- + crane
- + monument
- + openAirPool
- + protectiveStructure
- + pylon
- + retainingWall
- + solarPanel
- + substation
- + tunnel

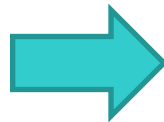


Current use

Code list hierarchical and extensible based on Eurostat classification

We have to adapt our complet classification of buildings to a much more simple classification.

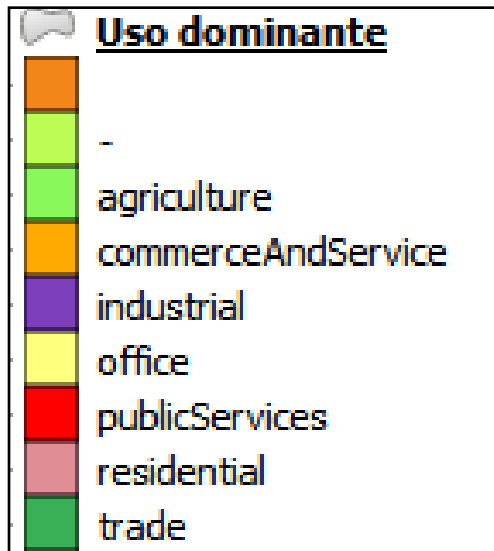
residential
 individualResidence
 collectiveResidence
 twoDwellings
 moreThanTwoDwellings
 residenceForCommunities
 agriculture
 industrial
 commerceAndServices
 office
 trade
 publicServices
 ancillary



catastro		INSPIRE/uso (PROPIETARIA)	
CODUS	Denominacion		GML
A	Almacen, estac.	warehouseAndParking	warehouseAndParking
B	Almacen agrario	Agriculture, warehouse	agricultureWharehouse
C	Comercial	CommerceAndService,trade	trade
E	Cultural	CommerceAndService,culture	Culture
G	Ocio, Hosteleria	CommerceAndService,RecreatioAndHoReCa	recreatioAndHoReCa
I	Industrial	Industrial, General	Industrial
J	Industrial agrario	Agriculture, Industrial	agricultureIndustrial
K	Deportivo	CommerceAndService,sports	sports
M	Suelo sin edificar	-----	
O	Oficinas	CommerceAndService,office	office
P	Edificio singular	singularBuilding	singularBuilding
R	Religioso	CommerceAndService,religious	religious
T	Espectaculos	CommerceAndService,shows	shows
V	Residencial	residential	residential
Y	Sanidad, Benefic	CommerceAndService,healthAndCharity	healthAndCharity
Z	Agrario	Agriculture,general	agriculture
1	RDL 1/04 8.2a e) Los destinados a la producción de energía eléctrica y gas y al refinado de petróleo, y las centrales nucleares.	Industrial, Energy	energy
2	RDL 1/04 8.2b b) Las presas, saltos de agua y embalses, incluido su lecho o vaso, excepto los destinados exclusivamente al riego.	Industrial, Hydroelectric	hydroelectric
3	RDL 1/04 8.2c c) Las autopistas, carreteras y túneles de peaje.	CommerceAndService,tollRoadsAndTunnels	tollRoadsAndTunnels
4	RDL 1/04 8.2d d) Los aeropuertos y puertos	CommerceAndService,airportsAndPorts	airportsAndPorts

Current use

***In a building we have many uses:
 We gave the predominant and the secondary use with %.***





«codeList» BuildingNatureValue	
+ arch	
+ bunker	
+ canopy	
+ castle	
+ caveBuilding	
+ chapel	
+ church	
+ dam	
+ greenhouse	
+ lighthouse	
+ mosque	
+ shed	
+ silo	
+ stadium	
+ storageTank	
+ synagogue	
+ temple	
+ tower	
+ windmill	
+ windTurbine	

*Spanish Cadastre dataset has not this attribute
Topographic institutes, well*

BuildingNatureValue

Nature of a building or part of building

*Is classified by its **shape, aspect or purpose** NOT for its use.*

To add

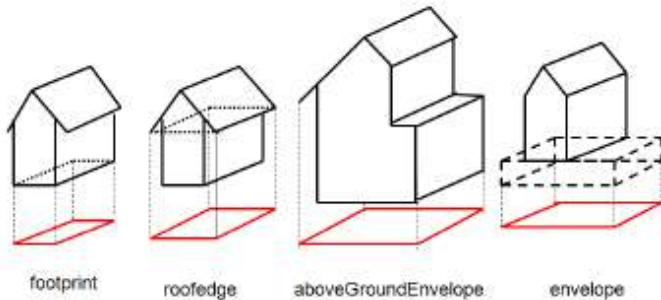
		en vietnam.	
<u>dovecote</u>	palomar		
<u>pigeonnier</u>			
<u>water mill</u>	molino de agua		
<u>bullring</u>	plaza de toros		
	refugio de montaña		2?



Elevation Roof type

*Spanish Cadastre dataset has not these attributes
Topographic institutes, well*

Geometry



*For cadastre:
2D*

Horizontal reference: footprint

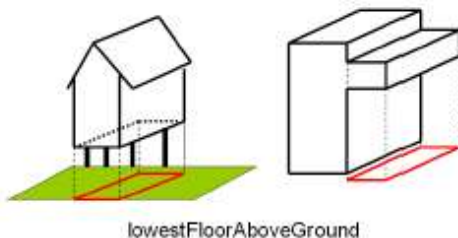


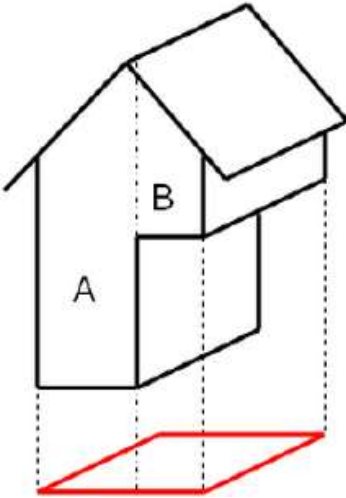
Figure 21: Examples of HorizontalGeometryReference

*But topographic Institutes can have
2,5D, 3D and other horizontal
references*

Error in the INSPIRE schema Building 2D !!!!

In the text is correct

NOTE : the 2D application schema requires that both the geometry of the Building and of BuildingPart have to be provided (multiplicity [1..*]). In some cases, the value "combined" may be used to provide the horizontal geometry reference of Building, as shown in following illustration.



BuildingPart A was captured by its footprint.

BuildingPart B was captured by its lowest floor above ground.

The Building geometry was obtained by merging the geometries of A and B.

The horizontal geometry reference of the building will be **combined**.

In the UML and in the example of GML is wrong

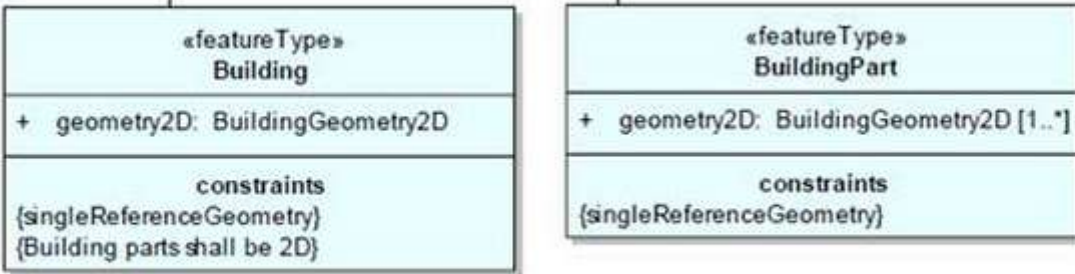


Figure 25: The Buildings 2D application schema



numberOfBuildingUnits

`<bu-ext2d:numberOfBuildingUnits>18</bu-ext2d:numberOfBuildingUnits>`

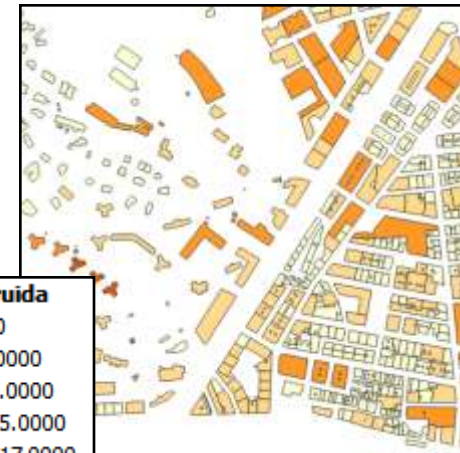
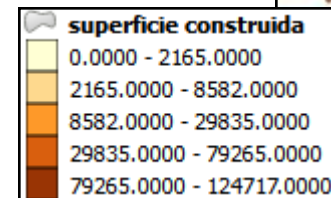
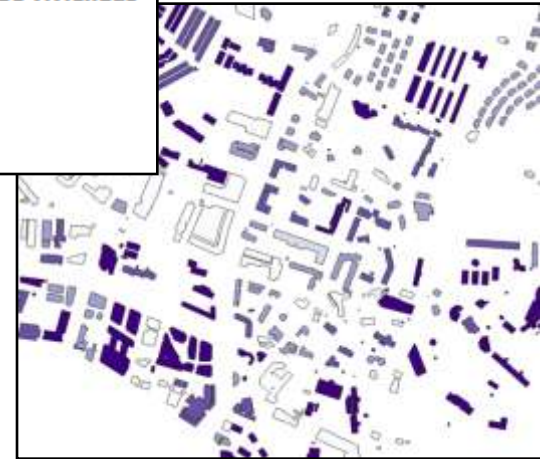
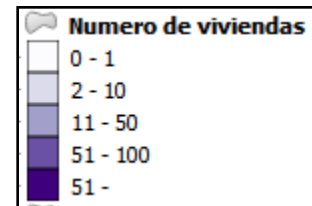
numberOfDwellings

`<bu-ext2d:numberOfDwellings>17</bu-ext2d:numberOfDwellings>`

officialArea

`<bu-ext2d:officialArea>`
`<bu-ext2d:OfficialArea>`
`<bu-ext2d:officialAreaReference>Superficie construida</bu-ext2d:officialAreaReference>`
`<bu-ext2d:value uom="m2">2513</bu-ext2d:value>`
`</bu-ext2d:OfficialArea>`
`</bu-ext2d:officialArea>`

officialValue



document

<bu-ext2d:document>

<bu-ext2d:Document>

<bu-ext2d:documentLink>

<https://www.sedecatastro.gob.es/Cartografia/FXCC/FotoFachada.aspx?refcat=9398516VK3799G>

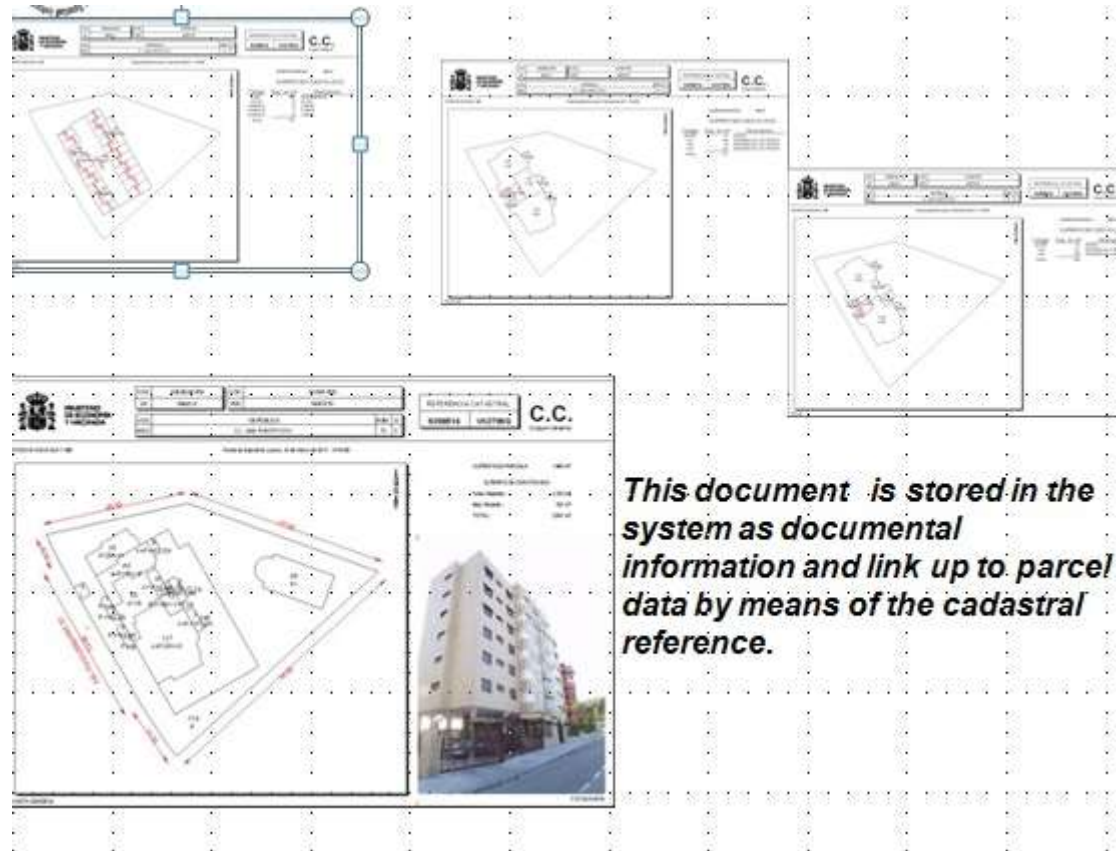
</bu-ext2d:documentLink>

<bu-ext2d:format>jpg</bu-ext2d:format>

<bu-ext2d:sourceStatus>NotOfficial</bu-ext2d:sourceStatus>

</bu-ext2d:Document>

</bu-ext2d:document>

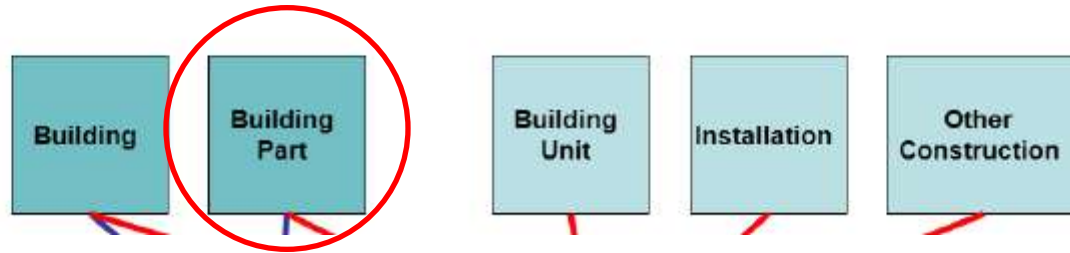


This document is stored in the system as documental information and link up to parcel data by means of the cadastral reference.



BuildingPart contiene unos atributos similares a los de Building:

Main feature types



numberOfFloorsAboveGround

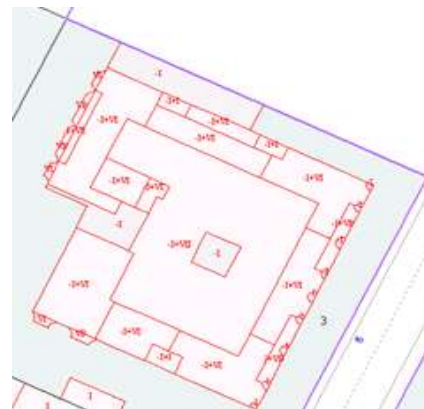
```
<bu-ext2d:numberOfFloorsAboveGround>6</bu-ext2d:numberOfFloorsAboveGround>
```

heightBelowGround y numberOfFloorsBelowGround

```
<bu-ext2d:heightBelowGround uom="m">3</bu-ext2d:heightBelowGround>
```

```
<bu-ext2d:numberOfFloorsBelowGround>1</bu-ext2d:numberOfFloorsBelowGround>
```

The ID of the part has the same ID of the building + a sequential





INSPIRE Services



with all these information the Spanish cadastre generates the INSPIRE GML files.

it possible to automate the processes in order to be able to generate metadata and INSPIRE services for viewing and downloading.

View.....



Down load.....





PORTRAYAL

We adapt the symbols defined in the portrayal of the specifications for its representation in the INSPIRE view service, taking into account the overlap with other data sets as cadastral parcels and addresses.

Style Name	BU.Building.Grey
Style Title	Building Default style
Style Abstract	<p>The building reference geometry is represented by following style:</p> <ul style="list-style-type: none"> - Style for surface geometries ; Black with dark grey outline • Fill colour: SOLID GREY RGB 128,128,128 • Outline colour: RGB 90, 90, 90 • Outline width: 1px
Minimum & maximum scales	from 1:1 to 1:5.000

Style Name	BU.BuildingPart.Default
Style Title	BuildingPart Default style
Style Abstract	<p>The building reference geometry is represented by following style:</p> <ul style="list-style-type: none"> - Style for surface geometries ; hollow with gray outline • Fill colour: Transparent • Outline colour: RGB 90, 90, 90 • Outline width: 1 px
Minimum & maximum scales	from 1:1 to 1:2.000



INSPIRE. View Service

- *WMS service versión 1.3.0*
- *Own Developing*
- *Continuous map for the whole territory*
- *Integrated in the Cadastral Virtual Office*
 - *7 days , 24 hours , free of charge*

<http://ovc.catastro.meh.es/cartografia/INSPIRE/spadgcwms.aspx?>



INSPIRE. View Service



Layers

Styles

CP.CadastralParcel

- CP.CadastralParcel.Default
- CP.CadastralParcel.LabelOnReferencePoint
- CP.CadastralParcel.BoundariesOnly
- CP.CadastralParcel.ReferencePointOnly

CP.CadastralZoning

- CP.CadastralZoning.Default
- CP.CadastralZoning.BoundariesOnly

AD.Address

AD:Address.Default

BU.Building

BU.Bulding.Default

BU.BuildingPart

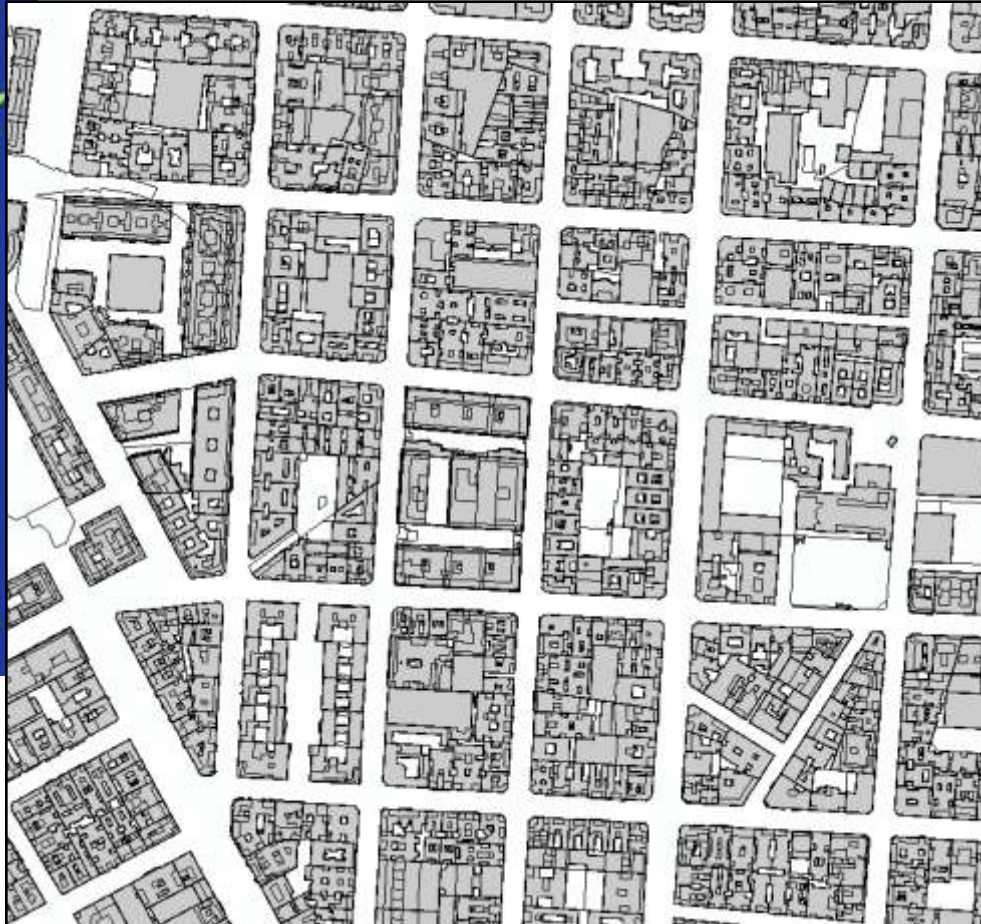
BU.BuldingPart.Default

Spanish General Directorate for Cadastre
INSPIRE View Services - WMS
SYMBOLOLOGY

CP.CadastralParcel	
style Default	<input type="text" value="23"/>
style BoundariesOnly	<input type="text" value=""/>
style ReferencePointOnly	<input type="text" value="+"/> +
CP.CadastralZoning	
style Default	<input type="text" value="23345"/>
style BoundariesOnly	<input type="text" value=""/>
AD.Address	
style Default	<input type="text" value="□"/>
BU.Building	
style Default	
BU.BuildingPart	
style Default	



INSPIRE. View Service



Building + BuildingPart

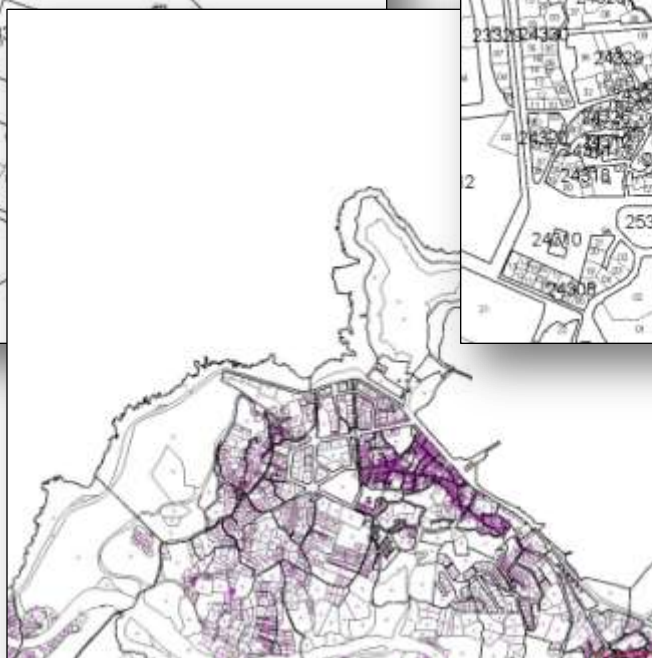
<http://ovc.catastro.meh.es/cartografia/INSPIRE/spadgcwms.aspx?>



Services

INSPIRE. View Service

 GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y HACIENDA
SECRETARÍA DE ESTADO DE HACIENDA Y PRESUPUESTO
SECRETARÍA GENERAL DE HACIENDA
DIRECCIÓN GENERAL DEL Catastro



INSPIRE. View Service

WMS INSPIRE



<http://ovc.catastro.meh.es/cartografia/INSPIRE/spadgcwms.aspx?service=wms&request=getmap&format=image/jpeg&bbox=512300,4663000,512500,4663200&width=1000&height=1000&srs=epsg:23029&layers=cp.cadastralparcel,cp.cadastralzoning,bu.building>

WMS Catastro



<http://ovc.catastro.meh.es/cartografia/wms/servidorwms.aspx?service=wms&request=getmap&format=image/jpeg&bbox=512300,4663000,512500,4663200&width=1000&height=1000&srs=epsg:23029>



INSPIRE. Down-load Service

Atoms: *predefined data set*

we generate for each municipality a zip file :

1. metadata.
2. Gml file.

A.ES.SDGC.BU.R.53026.zip



Fichero zip

A.ES.SDGC.BU.MD.R.53026.xml

Fichero xml de metadatos

A.ES.SDGC.BU.R.53026.gml

Fichero gml con el dataset

This Atom files are generated, in an automatic way by our own application each 4 months



INSPIRE. Down-load Service

WFS for Buildings

Similar to Cadastral Parcel

<http://ovc.catastro.meh.es/INSPIRE/wfsBU.aspx?>

With queries as

- *get a building,*
- *get a neighbor building,*
- *get the cadastral reference of the building etc*

With restrictions as

- *extension of the window*
- *number of elements etc*





Conclusions

Spanish Cadastre can already provide the INSPIRE BU services with the cadastral attributes : geometry 2d, surface, use, number of floors, below and over the floor, conservation status, year of construction, number of dwellings, cadastral reference, address etc...

But **we need to combine these data with the topographic data** that provide regional and local organizations and that has **totally other information**, other geometry (2,5D or 3D) for Building and Building part and other attributes as building nature, height, roof-edge etc... and also they have other construction as (bridges, walls,) that are not in the cadastral data





Creation of the Consensus Model for Spain of INSPIRE Building data