BTN100/BCN200: Collaborative framework for cost optimization

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Abstract. This paper describes a global view of the geospatial production in a collaborative framework between the National Geographic Institute (IGN) and the Geographic Center of the Army (CEGET). This is a multipurpose environment that pursues the production of printed and digital cartographic products at small scales (1:100.000 to 1:400.000).

This agreement was signed on the 25th of November 2010 establishing a collaborative approach for harmonized production of official series produced by the National Geographic Institute of Spain (IGN-E) and the Army Geographical Centre (CEGET). It should be noted that this project is an explicit statement of the National Cartographic System by the agencies assigned to both Ministry Departments, Public Works and Defense, nowadays incorporated into the 14/2010 law of July the 5th about Infrastructure and Geographic Information Services in Spain.

This law transposes part of the INSPIRE Directive. Consequently this collaborative agreement intends to adapt their production systems for Spatial Data Infrastructure (SDI), Geographic Information Systems (GIS), as well as a printed cartography to ensure a better organization of public services and geographic information mapping on the basic principles of cooperation and coordination between authorities in the matter.

Within this environment and in a cooperative way, a common topographic database will be produced and it will be the basis to obtain the different series and specific cartographic databases for each institution directly. This common core is known as the National Topographic Data Base at scale 1:100.000 (BTN100).

The collaborative framework does not a single database, since there are a wide range of scales involved, and its purposes are many. For this reason we

decided to get a new National Cartographic Data Base at 1:200,000 scale (BCN200) obtained from generalization and editing from BTN100. Thus, BTN100 is mainly topographic; their applications are mainly for GIS purposes like the National Geographic Information System (SIGNA), or the National SDI, like the Spanish Spatial Data Infrastructure (IDEE). Furthermore, BCN200 aims cartographic tasks since it is the basis for the production of the Thematic and Derived Mapping Plan series produced by the IGN or NATO series produced by the CEGET: The Province Map at 200k (MP200), NATO Series 250C, the Spanish Map at 500k (ME500).

In order to crystallize materialize INSPIRE values, BTN100/BCN200 have incorporated information from several sources: Legal Boundaries Database managed by the Mapping Central Registry, the Geodetic Data Server by the Geodetic Observation Center, the Interactive Official Road Map by the Public Works Ministry and some information from the Corine Land Cover project by the Land Observatory. The rest of the information has been obtained by re-engineering processes from the old data model.

Keywords: Maps / data production, user data/maps, spatial data infrastructures (SDI)

1. Introduction

On November the 25th an agreement between IGN (Spanish National Geographic Institute) and CEGET (Geographical Center of the Army) was signed. This agreement establishes a collaborative framework for the unification of both organisms official cartographic series. An item to highlight in this project is that represents an explicit statement of National Mapping System by institutions belonging to the two Ministerial Departments in charge, Fomento (Public Works) and Defense. Nowadays, it has turned into the Law 14/2010 of 5 July on Infrastructure and geographic information services in Spain.

Since this law transposes precepts of the INSPIRE Directive, the main goal of this agreement is to adjust their different Spatial Data Infrastructure (SDI), Geographic Information Systems (GIS) and printed cartography production systems into a common framework to ensure a better organization of public services and mapping geographic information on the basic principles of cooperation and coordination between authorities carrying out their mandatory tasks in this area [BOE10].

The collaborative framework IGN-CEGET desires to define, capture and maintenance of two national geographical databases. The National Topographic Base 1:100,000 (BTN100), mainly used in GIS applications, and the

National Cartographic Base 1:200,000 (BCN200) also introduces cartographic parameters that facilitate the publication on paper of different series of both institutions.

Based on these statements, the present paper is structured according to two main sections:

BTN100 defined as a geographic information system that holds multi topographic and thematic data, and is able to provide support to both geographic queries as to the production of various cartographic products. This provides support for printed cartography like C Series (CEGET), GIS projects like the National Geographic Information System (Signa) or IDE as the Spatial Data Infrastructure of Spain (IDEE). Data model have been expanded to incorporate the requirements requested by different national projects such as the Strategic Infrastructure and Transport (PEIT) or international ones as Eurogeographics (EuroReginalMap or EuroGlobalMap). BTN100 also taken into account in defining the model phenomena that were all part of the BCN200, in other words, those who will be featured in smaller scale map series.

BCN200 generated from the generalization and editing tasks on BTN100 semiautomatic, which as indicated previously, has a clear mapping purpose, serving as basis for the production of the 1:200,000 map Provincial (MP200) series and Autonomous Regions map (1:300,000 and 1:400,000 scales), furthermore, IGN acts as a source to the series 1501 NATO CEGET (1:250,000 scale).

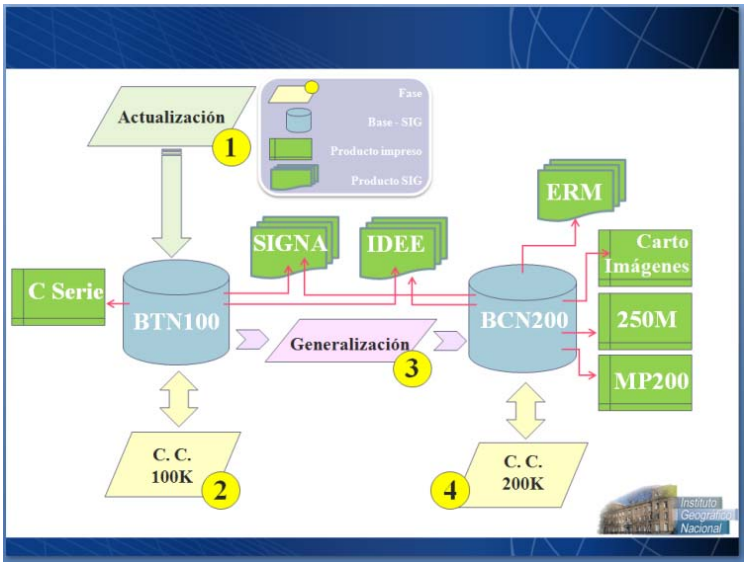


Figure 1. Collaborative Frame Workflow

2. Background and Framework

Throughout its history, both the IGN and CEGET have been developing their respective series at different scales:

- CEGET has been publishing the L series (scale 1:50 000), the C series (1:100, 000), NATO 1501 series (1:250 000), NATO 1404 series (1:500, 000), and the 1: 1,000,000 and 1:1 500 000. map of Spain
- IGN presented his National Topographic Data Base NTDB25 (1:25 000), NTDB50 National Topographic Data Base (1:50 000), PM200 Province Map (1:200 000), Regional Maps (1:300 000-1:400.000), the ME500 map (1:500 000) and the 1:1.250 000 map of Spain.

Based on the different scales produced by both organizations, a scale gap was found between 1:50,000 and 1:200,000. Such gap is widely used in GIS and SDI as these are able to show in the same environment as both images in raster map series zoom function application. This was the reason that IGN and 1:100,000 CEGET define this as the basic scale collaborative environment for IDE and GIS cartographic production works at small scales.

From this premise, and based on data models at scales of 1:100,000 CEGET (Series C) and IGN 1:200,000 (formerly BCN200), a data model was completely rebuilt to allow collaborative updating, using GIS technology, the data necessary for both institutions.

At this point, it is necessary to make a clarification, so that the terminology does not lead to confusion throughout the development of this article. More particularly regarding to BCN200. And the old BCN200 was a geographic database in which the elements retain their real scale. However, the current BCN200 already presented above, is a map database in which some elements are moved from their original position in order to avoid overlap and provide a model which allows obtaining fast cartography.

Another issue to be clarified is the aim that had different models that was merged to generate BTN100. While the former BCN200 has become clear that it was intended to produce both GIS and cartographic products, the C Series shows a model designed only for printed (digital or not) cartographic production . This is the reason that BTN100 has adopted the main features of the old model BCN200 while C Series enabled us to expand and complete the new model, besides, provides baseline information of those geographic objects that could be considered in better updating and quality.

Once such issues are clarified, we shall therefore briefly of what were the main features of these two models BTN100:

The **old BCN200**, now inherits BTN100 functionalities:

- The way the items are stored involves a spaghetti-like structure, so that, by not storing topological primitives, it is possible to store duplicate geometries.
- The data is classified into eight topics of themes, each with multiple tables, which are:
  - ✓ Theme1: Administrative Entities
  - ✓ Theme 2: Relief
  - ✓ Theme 3: Hydrography
  - ✓ Theme 4: Land use
  - ✓ Theme 5: Buildings and settlements
  - ✓ Theme 6: Roads and railways
  - ✓ Theme 7: Pipelines
  - ✓ Theme 10: Ground mark
- Each theme is made up of different types of features and every feature class is stored in a table differently.
- Each feature class is defined by different attributes. There are attributes common to all classes and attributes of each class.

Series C is the successor to the "Map Headquarters Command and" established by Decree of 18 February 1933 on the "Regulation of Military Mapping". Its data model is devoted to publication on paper and regulatory Military 1:100,000 map, obviating use GIS. Formed historically sometimes directly and other from the four sheets of L Series (1:50.000) who comprises it. The data model is the same as L Series although reduced to suit the different scale:

- The data model is structured in a interlinked tables database (relational model) using a common (internal / external key). It is based on the spaghetti type topology so that there is a possibility of duplicate geometries. Stored entities are: text, point, line or area.
- The data is stored in different kinds of features and each feature class is stored in a singular table. Within each table may have different types which differ by an attribute called "class".
- The data is classified into 11 topics, which are:

- ✓ Transportation
- ✓ Buildings and settlements
- ✓ Public works and industrial areas
- ✓ Landmarks
- ✓ Administrative Boundaries
- ✓ Mining
- ✓ Hydrography
- ✓ Contours and height points
- ✓ Land use
- ✓ Texts

- Each feature class belongs to a topic and is defined by different attributes. There are common attributes to all feature classes (objid, IDMAP, class, Geometry, Geometry_sk) and each feature class has also its own attributes.

3. BTN100

3.1. Objectives and phases

The objectives for obtaining BTN100 prove the advantages of institutional collaboration:

- Using the same data sources for updating and quality testing in both agencies.
- Getting different views regarding collection, updating, editing and quality control when applying these processes to the final product.
- Optimization of costs and time to generate a single product for both organisms and not a different product at the same scale for each of the agencies.
- Data, metadata and information standardization.

BTN100 Project phases include:

1. The definition of the new data model, adding new feature classes and attributes to the previous existing model (BCN200) to meet the needs of CEGET, as well as other projects' needs such as ERM or PEIT. As a result a new DB schema is produced including feature classes, catalog tables and relations among them using foreign keys.

2. The definition of all documentation associated with the model: a Feature Catalog and a Data Dictionary as well as a Specifications document that explains the methodology and data capture rules.

3. Data collection under the new model schema. The input data comes from both organisms: CEGET and IGN. Now the core DB is formed.

4. Updating the data using high resolution images (from SPOT5 satellite scenes of 2.5 m resolution) and orthoimages from the National Remote Sensing Plan and other specific data sources depending on the feature class.

5. Topological, Semantic and Geometric Quality Control in order to validate the final product and assure its quality according to the Specifications.

3.2. Data Model

The fundamental BTN100 feature classes have already been defined in the background section, as this new model is based on the previous existing model (BCN200). However some aspects may be highlighted and clarified [IGN11-1]:

- It is a relational data model where each phenomenon is stored in the database as a feature class in which the geometry is stored in an specific field. We should point out that, in this model, each element of a particular Feature Class is not a feature itself but the part of a feature that remains with the same attributes invariant excluding the geometry. That is, in BTN100, the data are stored in the lowest possible structuring range, such that on one hand subsequent structuring is direct and on the other hand allows a thematic classification and symbolization.
- No topological primitives are stored, so if there are several elements partially or completely sharing their geometry, its geometry is repeated (that is, for example, the case of hydrographic features coincident with an administrative boundary).
- Collections of geometries are not allowed in this model.
- The model has a total of 60 feature classes, structured in 8 topics (Table 1).

Tema	Clases de entidad
ADMINISTRATIVE UNITS	02
CONTOURS AND HEIGHT POINTS	03
HYDROGRAPHY	12
LAND USE	04

BUILDINGS AND SETTLEMENTS	11
TRANSPORTATION	16
PIPELINES	08
LANDMARKS	02
TOTAL	60

Table 1. Feature classes by Topic

- In each of the 60 feature classes there are specific attributes and common attributes: ID, ID_BD, ID_SIMPLE, ID_CODIGO, ID_HOJA, ID_MOD, FECHA_ALTA, FECHA_BAJA, LABEL, Geometry and Geometry_sk.
- The name of the tables that represent each of the feature classes is defined by:

  BTN100_TTFFG_ALIAS. Where:

  TT: two digits for the topic

  FF: two digits for the feature class in that topic

  G: one letter for the geometry type: point (P), line (L) or surface (S).

  ALIAS: is the short name of the feature class.

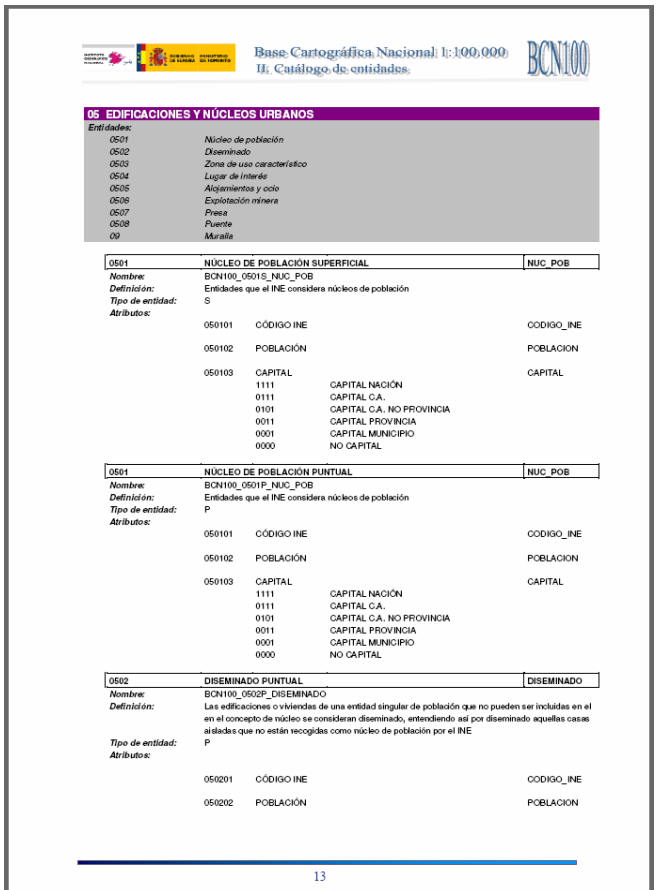
- BTN100 allows the possibility of including controlled lists of values for certain attributes by the use of picklists. This is the case of those attributes in the model that have restricted values (as explained in the data dictionary). For this purpose there are two linked tables : The Attributes table and the Values Table s. These tables are managed through a third table called GPickListTable. None of these three tables contain geometries.
- There are also catalog tables (such as *FieldLookup, GFeatures* ó *AttributeProperties)* that make the model useful in GIS software.

BTN100 was designed to provide services for several different users and GIS and Mapping projects. Therefore some of the Feature Classes included in BTN100 (and by extension in BCN200) give the idea of how versatile and interoperable is the model. Here we list some of the advantages regarding interoperability:

- The administrative units (BTN100_0101S_ENT_TERRIT) were obtained from the official existing Administrative Boundaries DB managed by the IGN Mapping Central Registry. Therefore the unique official thematic ID is included.
- The main hydrographic features (BTN100_0301L_RIO) have a special standard identifier. This is the SIA_Code, and its value corresponds to the code associated with this phenomenon in the Water Integrated Information System. This code enables not only the interoperability with many GIS hydrographic data but also the structuring processes of the BTN100.
- All settlements (BTN100_0501S_NUC_POB) have also a special standard identifier. This identifier is the National Statistic Code (INE_Code attribute).
- Most of the declared Cultural Interest Points (BIC) by the Ministry of Culture are captured as BTN100_0504P_LUG_INT in BTN100. These elements have its own unique standard identifier (BIC_Code)
- Other BTN100 feature classes have a unique standard international identifier as well. (TENT_Code for routes, UNLO_Code for seaports, IATA_Code and ICAO_Code for airports, etc.)

3.3. Data model documentation

3.3.1 Features Catalog: it is a detailed list of feature classes, classified by topic, and defining for each feature class its specific attributes and what are the possible values and descriptions. Each attribute is further contemplated, with a short name and data type [IGN11-2].



Base Cartográfica Nacional 1:100.000
BCN100
II. Catálogo de entidades

05 EDIFICACIONES Y NÚCLEOS URBANOS

Entidades:

0501	*Núcleo de población*
0502	*Diseminado*
0503	*Zona de uso característico*
0504	*Lugar de interés*
0505	*Alojamientos y ocio*
0506	*Explotación minera*
0507	*Presa*
0508	*Puente*
09	*Muralla*

0501	NÚCLEO DE POBLACIÓN SUPERFICIAL		NUC_POB
Nombre:	BCN100_0501S_NUC_POB		
Definición:	Entidades que el INE considera núcleos de población		
Tipo de entidad:	S		
Atributos:			
	050101	CÓDIGO INE	CODIGO_INE
	050102	POBLACIÓN	POBLACION
	050103	CAPITAL	CAPITAL
	1111	CAPITAL NACIÓN	
	0111	CAPITAL C.A.	
	0101	CAPITAL C.A. NO PROVINCIA	
	0011	CAPITAL PROVINCIA	
	0001	CAPITAL MUNICIPIO	
	0000	NO CAPITAL	

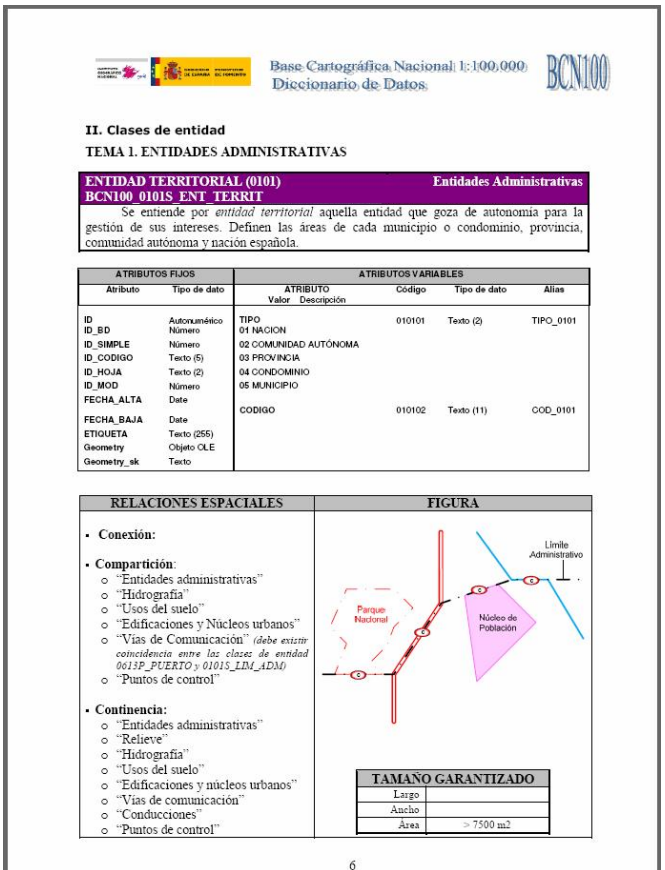
0501	NÚCLEO DE POBLACIÓN PUNTUAL		NUC_POB
Nombre:	BCN100_0501P_NUC_POB		
Definición:	Entidades que el INE considera núcleos de población		
Tipo de entidad:	P		
Atributos:			
	050101	CÓDIGO INE	CODIGO_INE
	050102	POBLACIÓN	POBLACION
	050103	CAPITAL	CAPITAL
	1111	CAPITAL NACIÓN	
	0111	CAPITAL C.A.	
	0101	CAPITAL C.A. NO PROVINCIA	
	0011	CAPITAL PROVINCIA	
	0001	CAPITAL MUNICIPIO	
	0000	NO CAPITAL	

0502	DISEMINADO PUNTUAL		DISEMINADO
Nombre:	BCN100_0502P_DISEMINADO		
Definición:	Las edificaciones o viviendas de una entidad singular de población que no pueden ser incluidas en el en el concepto de núcleo se consideran diseminado, entendiendo así por diseminado aquellas casas aisladas que no están recogidas como núcleo de población por el INE		
Tipo de entidad:	P		
Atributos:			
	050201	CÓDIGO INE	CODIGO_INE
	050202	POBLACIÓN	POBLACION

Figure 2. Example Features Catalog

3.3.2 Data Dictionary: it defines for each feature class [IGN11-3]:

- Name
- Definition.
- Fixed and variable attributes with their possible values.
- Possible combination of attributes
- Spatial relationships with other feature classes
- Schema of the spatial relationships
- Guaranteed minimum size, depending on the type of geometry.



Base Cartográfica Nacional 1:100.000
Diccionario de Datos

BCN100

II. Clases de entidad

TEMA 1. ENTIDADES ADMINISTRATIVAS

ENTIDAD TERRITORIAL (0101)	**Entidades Administrativas**
BCN100_0101S_ENT_TERRIT	

Se entiende por *entidad territorial* aquella entidad que goza de autonomía para la gestión de sus intereses. Definen las áreas de cada municipio o condominio, provincia, comunidad autónoma y nación española.

ATRIBUTOS FIJOS		ATRIBUTOS VARIABLES			
Atributo	Tipo de dato	ATRIBUTO Valor Descripción	Código	Tipo de dato	Alias
ID	Autonumético	TIPO	010101	Texto (2)	TIPO_0101
ID_BD	Número	01 NACION			
ID_SIMPLE	Número	02 COMUNIDAD AUTÓNOMA			
ID_CODIGO	Texto (5)	03 PROVINCIA			
ID_HOJA	Texto (2)	04 CONDOMINIO			
ID_MOD	Número	05 MUNICIPIO			
FECHA_ALTA	Date				
FECHA_BAJA	Date	CODIGO	010102	Texto (11)	COD_0101
ETIQUETA	Texto (255)				
Geometry	Objeto OLE				
Geometry_sk	Texto				

RELACIONES ESPACIALES	FIGURA
▪ **Conexión:** ▪ **Compartición**: o "Entidades administrativas" o "Hidrografía" o "Usos del suelo" o "Edificaciones y Núcleos urbanos" o "Vías de Comunicación" *(debe existir coincidencia entre las clases de entidad 0615P_PUERTO y 0101S_LIM_ADM)* o "Puntos de control" ▪ **Continencia:** o "Entidades administrativas" o "Relieve" o "Hidrografía" o "Usos del suelo" o "Edificaciones y núcleos urbanos" o "Vías de comunicación" o "Conducciones" o "Puntos de control"	

TAMAÑO GARANTIZADO	
Largo	
Ancho	
Área	> 7500 m2

Figure 3. Example Data Dictionary

3.3.3 Data Capture Rules: containing [IGN11-4];

- Internal (CEGET or IGN) and external DataSources. It classifies the sources in Main sources (old BCN200, Series C, SPOT5, PNOA, etc.) and complementary sources (RoadMaps, SIA, INE, etc.)
- Geometry capture parameters: display scale for capture, capture unit, geometry resolution, positional accuracy, etc.
- Attribute capture parameters
- Specific complementary rules for each feature class

3.4 Updating methodology

The basic scheme [IGN11-5] is structured in:

- Harmonization: it was necessary to harmonize the information, because the input data come from different sources and agencies and have different geometric resolutions.
- Edition: in order to give geometrical and topological consistency to the data.
- Updating: capturing new elements and deleting or modifying existing features according to the specific data sources established in the Data Capture Rules.

3.5 Compilation of baseline information: In the first phase of the methodology the goal is to upload the baseline information into the data-

base. It includes schema remodeling and geometric harmonization. There were several problems since the input data came from different organisms (CEGET, IGN, etc.) with several capture methodologies (photogrammetry, digitizing, etc.) and even different geometric resolutions (as it had some data at 1:50,000 and at 1:200,000 scales).

3.6 Updating the data: This phase consists of the practical application of the adopted methodology, establishing a workflow that includes two versions (with their corresponding quality tests and data validation) for each of the different units of the product (the province), before the final acceptance.

3.7 Quality Control: It is important to note that it has been developed according to the ISO19113 standard. This standard stablishes the quality principles and components for spatial data. In BTN100 quality control the validation is implemented by the use of GIS queries which are classified in the principal components of the ISO19113:

- *Completion*: commission or omission
- *Logical consistency*: conceptual consistency, Topological consistency and format.
- *Positional Accuracy*: absolute or relative
- *Thematic Accuracy*: qualitative or quantitative classification.

As a result of the quality control process a database in generated to report the errors encountered. This database contains one single feature class with composite geometry and different attributes that define the error and the element which has the error. The attributes of this Errors Database are:

- ID_ERROR: AutoNumber. Primary key of the table
- ID: identifier of the feature in error
- ID_CODIGO: identifier of the feature class that contains the feature in error.
- ERROR_TYPE: standard type of error (according to ISO19113)
- ERROR_DESCRIPTION: detailed standard description of the error
- COMMENTS: only if is necessary

Finally remark that there is also a previous quality control that is actually implicit in the restrictions imposed in the definition of the model. This refers to tables, attributes and values restrictions. Come of these restrictions include: user permits, restriction of entities, attributes and domains using supplementary tables, picklists and relationships between tables with referential integrity, etc.

4. BCN200

We have already mentioned that BCN200 is designed to directly produce cartography, at least as far as the position of the elements are concerned. It will be used to produce small scale maps such as the Priovince Map at 1:200,000 scale or the map at 1:400,000 scale. However, BCN200 is also a GIS product because, even if it has cartographic geometry, it manteins the topology and geometric coincidence and also has attributes that allow the user to make GIS queries.

BCN200 will also be the basis for the generalization to scale 1:500,000 producing the BCN500. The elements identifiers will be preserved in both scales.

Regarding the model, the features and how the data is produced, in this article we will only explain the main phases, that are shown in this diagram:

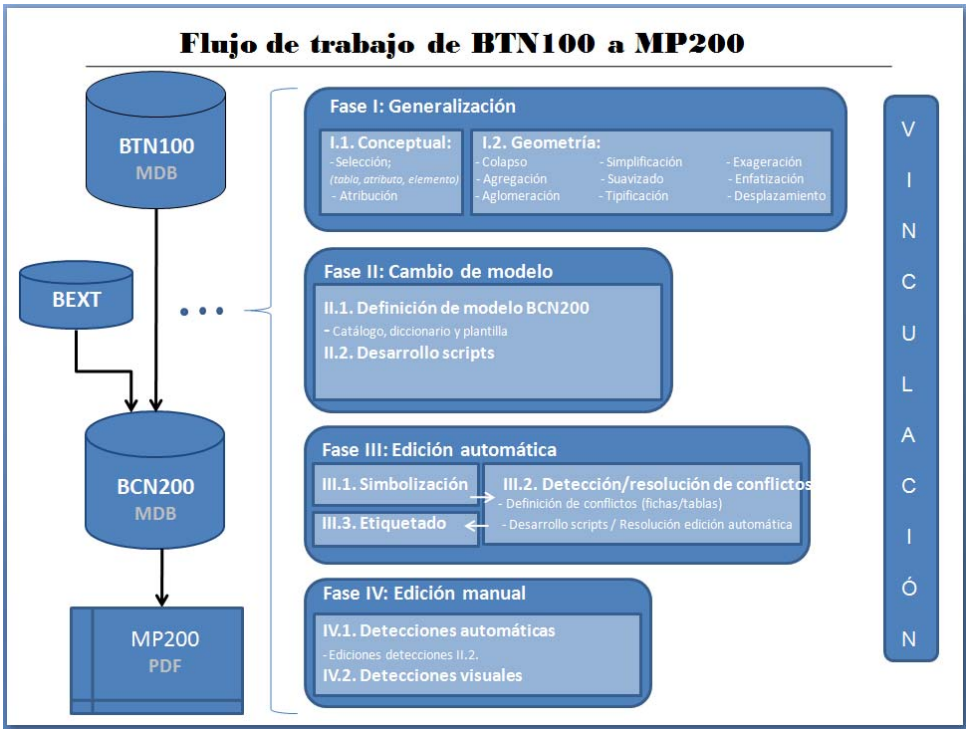


Figure 4. Workflow BTN100 to BCN200

4.1. Data Model

As in BTN100, we have designed a data model that provides the same functionality, and largely the same feature classes, with the obvious change of resolution containing geometries, which also leads inevitably to the elimination of classes that are not meaningful at 1:200,000 scale. It also includes changes in the attributes. This is implemented in a new data model schema that remodels the previous 60 existing feature classes in BTN100 to 47 new feature classes. This has been documented in an Specifications Document a Feature Catalog and a data Dictionary.

4.2. Workflow (From BCN100 to BCN200)

1.- Generalization

This requires a change in the geometric resolution, from 1:100,000 to 1:200,000.
The generalization is classified in:

- Conceptual: Selection of feature classes, elements and attributes. Some feature classes will cease to exist in BCN200 (cemeteries, pools, walls, etc.) In other feature classes only certain attribute combinations are possible.
- Geometric: Proper geometry according to the new scale (1:200,000) Each feature class will generalize differently and has established processes: collapse, aggregation, agglomeration, simplification, smoothing, typification, exaggeration, Boosting and / or displacement.

2.- Model Change

The elements and generalized BTN100 will be be stored in the BCN200 template. This means that the data have to be remodeled to match the new schema. Various ETL tools have been developed in order to remodel the data. Sometimes different feature classes from BTN100 are stored in one and sometimes one feature class from BTN100 is now stored in different feature classes. In some cases, not only the table and attributes change but also there is a geometry type change.

3.- Symbolization BCN200

To ensure that the geometry is valid for BCN200 representation, the MP200 symbology is been reproduced in the BCN200 workbench. So the geometry matches the scale and the map symbology. Moreover, we can detect and resolve potential conflicts in BCN200 visually before the mapping process.

4.- Semiautomatic Edition

The conflicts that we have detected visually are classified into different categories:

- Matching: they share the geometry
- Coalescence: some of the elements overlap because of the symbology (even if they don't share any vertex)
- Continence: An element is contained in a different element.

All the types of conflict of each feature class against other have been classified in these groups. Every case has been programmed to automatically detect the conflict using ETL tools.

5.- Semiautomatic Labeling

BCN200 has been conceived for the automatic labeling tasks. These are still in the process of innovation, but have given the best results at smaller scales as in the case of ME500 (Map of Spain 1:500,000). Only a few specific comments on the definition of the model for semiautomatic labeling;

- Virtual elements, which represent the guideline that is below each text. It is used in those geographic phenomena very difficult delimitation (mountains, landscapes, etc.)
- Attribute product, enabling the existence of many labels for the same phenomenon as other products in which it appears.

4.3. Link

This is one of the critical phases within the workflow. BCN200 and BTN100 have been developed in order to be linked. For future upgrades, and using change detection tasks, we can know de features to update in BTN100 an BCN200.

5. Conclusion

We can draw positive conclusions about this new situation for the work production of both institutions:

- *Better use of economic resources.* And both the CEGET as IGN, have not been immune to the economic situation in which our country finds itself and have decreased their budgets to the extent that they have also their respective departments. It is therefore possible to consider joint objectives maintenance maintain bases, which would not be possible separately.

- *Synergies of experiences and working methods.* Both the technical documentation such as the control of capture and update allowed combining the experience of two institutions with long experience, which so far focused their products for different purposes. This has made it possible to have different views when addressing similar situations, completing one another with a value in the determination of the final solution.
- *Uniformity of information.* The final consequence is a homogeneous product. That is, both data and metadata will be unique for both institutions, ensuring that all products of national officers have consistency in the basic information.

References

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[IGN12-2] L. Sanz Bueno, C. Ruiz Ramírez. "Mapa provincial 1/200.000: nueva imagen y una producción más eficiente"

[BOE10] *http://www.boe.es/boe/dias/2010/07/06/pdfs/BOE-A-2010-10707.pdf*

[DOUE07]*http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:ES:PDF*

[IGN11-1] Modelo de datos de BTN100.

[IGN11-2] Catálogo de entidades de BTN100

[IGN11-3] Diccionario de datos de BTN100

[IGN11-4] Normas de captura y actualización de geometrías y atributos de BTN100

[IGN11-5] Metodología de captura y actualización de BTN100.