Cross-border Cartography for French New Base Map at 1:25 000 scale

François Lecordix, Paul-Emmanuel Gautreau, Yann Sciardis

Institut national de l'information géographique et forestière
Service des développements
73 avenue de Paris, 94165 Saint-Mandé, France

Abstract. This paper presents an experience for cross-border cartography from Digital Landscape Model (DLM) to a Digital Cartographic Model (DCM). This experience was launched to produce cross-border tiles of the new Base Map Type 2010 at 1:25 000 scale that IGN started to produce on whole France.

Keywords: Cartography, Cross-border, DLM, DCM

1. Introduction

In France, the national mapping agency IGN developed a new production flowline of Digital Cartographic Model (DCM) at 1:25 000 scale, by tiles of 20 km x 20 km, deriving from the initial data stored in a Digital Landscape Model (DLM). The flowline was ready at the end of 2010 (and so this map is called Base Map Type 2010) and the production started in 2011 with many tiles realized inside France.

To produce all tiles it was necessary to define how to process for the cross-border tiles, where two different DLM are available on each part of the border. An internship was launched in September 2012 at IGN France to examine this problem and to propose solutions.

This paper will present first the flowline to produce the DCM at 1:25 000. A second part will examine the problems of the cross-border cartography and the proposed solution will be presented with some results obtained with IGN Belgium data.

2. Base Map Type 2010

2.1. General description

Since the end of the 1980s, IGN has been producing the BDTopo®, a DLM with a precision of 1 m. This DLM contained all vector information (networks, buildings, landscape, point, etc) for producing topographic Base Maps at 1:25 000 from 1993 in a new version called Type 93. But, in 2000, IGN produced only 25% of the French territory in BDTopo®. To speed up the constitution of BDTopo®, new specifications and processes were selected to finish the DLM collection on the whole territory in 2007. This decision implied that the production of Type 93 would be not possible: some information would be not present to produce the maps that the users wish to obtain.

So, in 2004, IGN launched the New Base Map Project with many challenges such as, defining processes to collect additional information necessary for cartographic production, for deriving 1:25 000 and 1: 50 000 seamless DCMs, with some human operators in an user friendly interface environment, for proposing an automatic process to propagate the updates collected in DLM in DCM and, last but not least, the requirement that this should be slightly less expensive than previous flowlines even if there is less information in the new version of BDTopo®. This last requirement implied to introduce a lot of automatic solutions, in particular for the cartographic derivation processes.

During the period 2004 – 2011, between 3 and 5 people developed the processes in the New Base Map Project (Maugeais et al. 2011). During that period, some modifications were introduced in IGN vector databases: different DLMs that IGN managed independently were merged into only one DLM called BDUni. BDUni is managed in DBMS Postgre in a seamless database and the GIS software GeoConcept (from Geoconcept, French company) is used to edit data. The communication between the DBMS and GIS is done by the software GCVS that IGN had developed.

To complete the information stored in BDUni, and so to be able to produce maps, the New Base Map Project defined a new database, called BDComplementaire. In this database, touristic information, itineraries, contour lines... are stored and different processes were defined to collect this information. BDComplementaire is managed too in DBMS Postgre in a seamless database, the GIS GeoConcept allows editing the data and the communication between the DBMS and GIS is done by the software GCVS.

With this complete information for the map, two main steps can be launched:

- a first step merges BDUni and BDComplementaire to obtain the new database BDRef. This BDRef is independent of scale and symbolization, but some operations are applied to compute information and to introduce consistency: building and dual carriageways are merged, itineraries are conflated on topographic networks (roads and tracks), urban structures (used for generalisation) like settlement areas or city blocks are computed from buildings contours and networks.
- a second step derives from BDRef the DCM France25 at 1:25000 or the DCM France50 at 1:50000. In these DCMs, the symbolization is computed at the beginning of the process and then automatic generalisation with Agent (Ruas 1999, Barrault 2001) and beams (Bader 2001) solutions and label placement processes (Lecordix 1994, Barrault 1998) are launched.

During these automatic processes, manual editing is applied in these 2 steps to improve the results. *Figure 1* shows this general process.

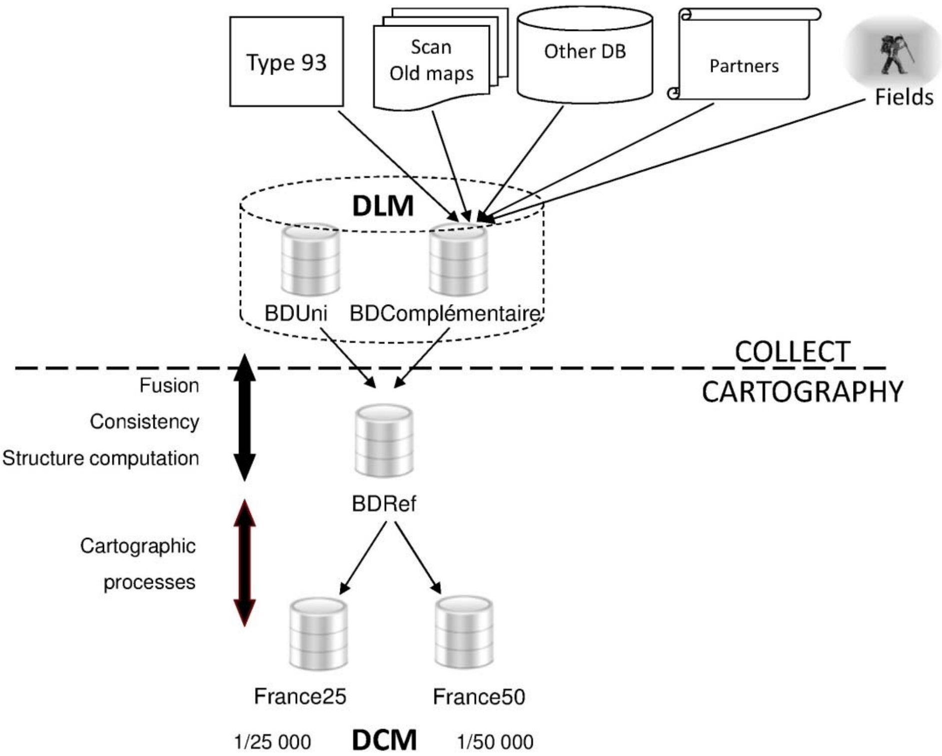

Figure 1. General process for Base Map Type 2010

2.1. Technical architecture

The architecture retained for cartography is again similar with BDUni's architecture, but it has an extra software specific to cartography. Postgre provides the DBMS, the interactive editor is GeoConcept, with a specific layer designed for cartography, Publisher (Guislain and Lecordix 2011), and GCVS provides the link with DBMS. The software Clarity (from 1Spatial, English company) was retained for automatic cartographic processes (mainly for generalisation). The New Base Map Project actors developed a specific bridge between GeoConcept/Publisher and Clarity, called CLEO, which allows exporting data from GeoConcept to Clarity, to launch automatically cartographic processes in Clarity and then to send data from Clarity back to GeoConcept. For automatic label placement, the IGN solution WinPAT, used for many other flowlines, was reused with again a data export from GeoConcept and then to send placed labels from WinPAT back to GeoConcept. *Figure 2* shows the software architecture for collect and cartography.

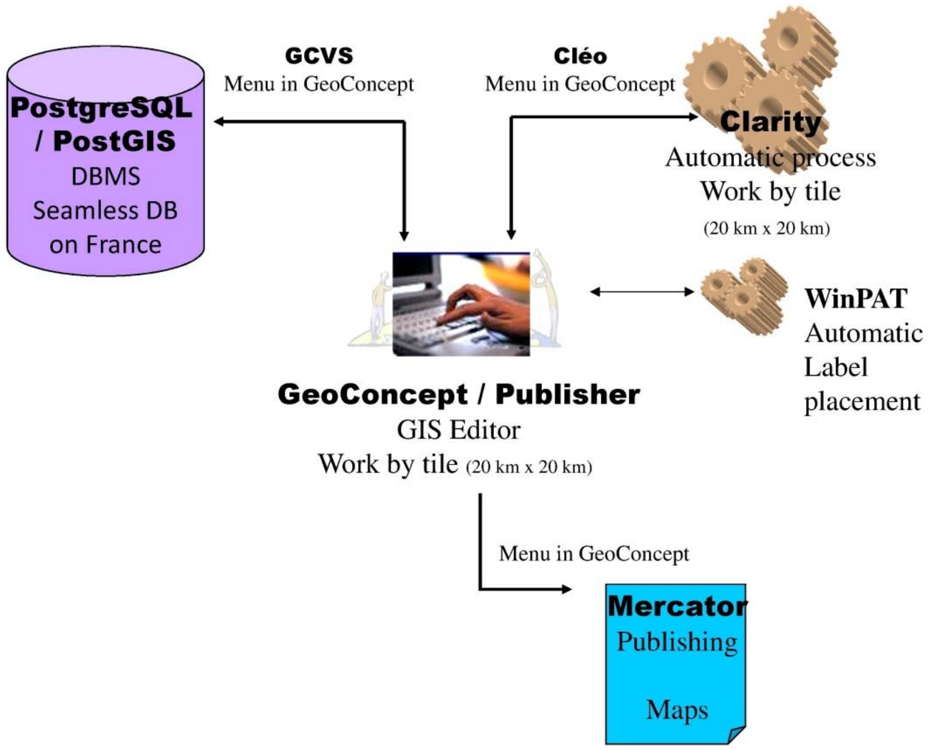

Figure 2. Software architecture for collect and cartography of Base Map Type 2010

2.2. Production

This full process is applied on tiles of 20 km by 20 km and a specific process was developed for cartographic tiles edge reconciliation to obtain the complete seamless cartographic database France25 which will allow extracting vector map on the wished area.

At the end of 2012, 317 tiles have been collected and 136 of them have been mapped on the 1637 tiles to produce on France. For one tile, an average of 280 hours is necessary to collect information in BDComplementaire and, for a part, in BDUni and 175 hours to derive France25 (*Figure 3*).

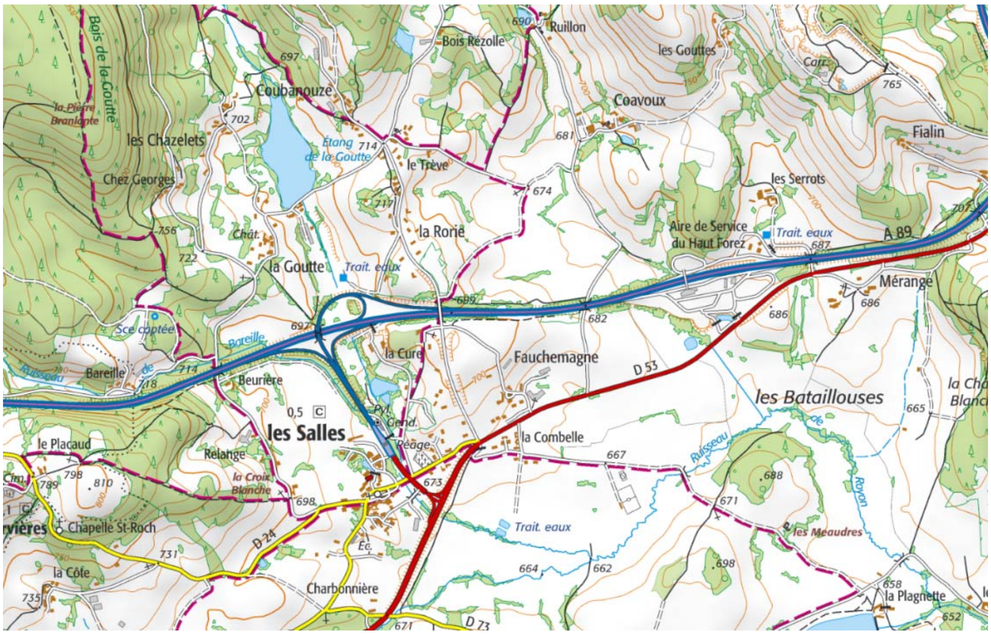

Figure 3. Extract Base Map Type 2010

3. Cross-border Cartography

3.1. Solutions used in the past

The specific cases must be examined henceforth to be able to produce all tiles. A specific case concerns the cross-border tiles where the information required for producing the whole tile, in particular the foreign part, is not available in the BDUni which limits his contain to the French territory. An example of the result obtained with the present process on the tile of Hendaye (France), in border with Spain, is provided in *Figure 4*. The lack of information on the Spanish part can be observed.

Figure 4. Tile of Hendaye in border with Spain, without data in the foreign part.

For previous edition of maps at 1:25 000 scale, obtained in the past with traditional process and updated now in a raster mode, the used process consisted, by traditional way or by raster process, in the integration of cartography provided by the foreign NMA on their own country (*Figure 5*). For other smaller scales of maps, the solution used at IGN consists in a digitalization of the foreign information from existing maps in the data model of French map. These solutions don't allow providing either a homogeneous representation on the both sides of frontier (first case), either a low cost of production (second case).

Figure 5. Extract of the actual 1:25 000 scale map on Revin, at the border between Belgium and France, with 2 different representations.

3.2. New Cross-border Cartography

IGN France decided to launch in September 2012 an internship to propose a new solution exploiting the similar DLM produced by our European neighbor counterpart. This experimentation was done by Paul-Emmanuel Gautreau with data provided by IGN Belgium.

The principle of work consists in adding a previous treatment with 2 steps in the process to use Belgian DLM: a translation of Belgian data model and data projection of foreign part in BDuni and BDComlementaire is applied, and then an edge reconciliation of Belgian data with French data is done in the border. By this way, a complete BDuni and BDComplementaire are obtained on this tile and the cartographic process described above can be applied without modification on the whole cross-border tile (*Figure 6*).

In practical, the software Radius Studio from 1Spatial was chosen to experiment the translation of Belgian data model in French data model and the edge reconciliation. This solution with Radius studio provides the possibility to introduce these 2 steps without development.

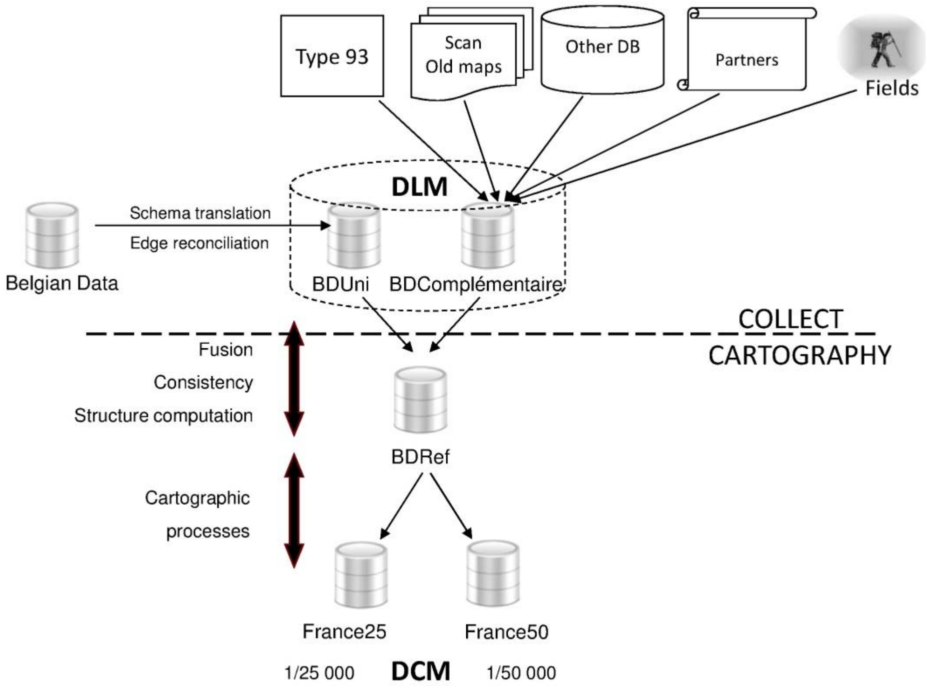

Figure 6. Adaptation of the general process for Base Map Type 2010 to produce a tile at the border between Belgium and France.

The main part of the work consists on the complete analysis of the schema of Belgian and French data model to be able to translate all Belgian objects with these attributes in French objects with attributes used for the symbolization. After this analysis of schema translation, the rules can be easily written with Radius Studio (*Figure 7*) and applied to obtain the Belgian data translated in BDUni and BDComplementaire model. Radius Studio is used with the DBMS Oracle (the direct link with Postgre doesn't exist in Radius Studio) and so all data are imported in Oracle.

For the second step, a specific rule was written in Radius Studio to manage the detection and the edge reconciliation on the border with a geometric translation of Belgian data.

After this Belgian data translation, all data in the cross-border tile are available in BDUni and BDComplementaire and the full Base Map Type 2010 process can be launched to obtain the France25 tile. Of course, for the first tile, many tests are applied to not forget some cases in the rules setup.

Figure 7. Rules example in Radius Studio to translate Belgian data in French schema of BDUni

3.3. Results

The proposed solution allows obtaining the complete cross-border tile with the same symbolization on the both parts of the border and the vector data are matched on the border (*Figure 8*), with an a very efficient way: less than 5 hours when the data translation is setup for the data of one foreign country).

Some symbolization attributes differences are observed on the border for some cases of roads and it will be necessary to examine if it is a problem on the rules or a misunderstanding on the attributes on each schema.

But, at this moment, some data are not examined and translated, in particularly labels where important differences exist between the 2 schemas and the way to structure these data to be able to use them with the label placement software WinPAT.

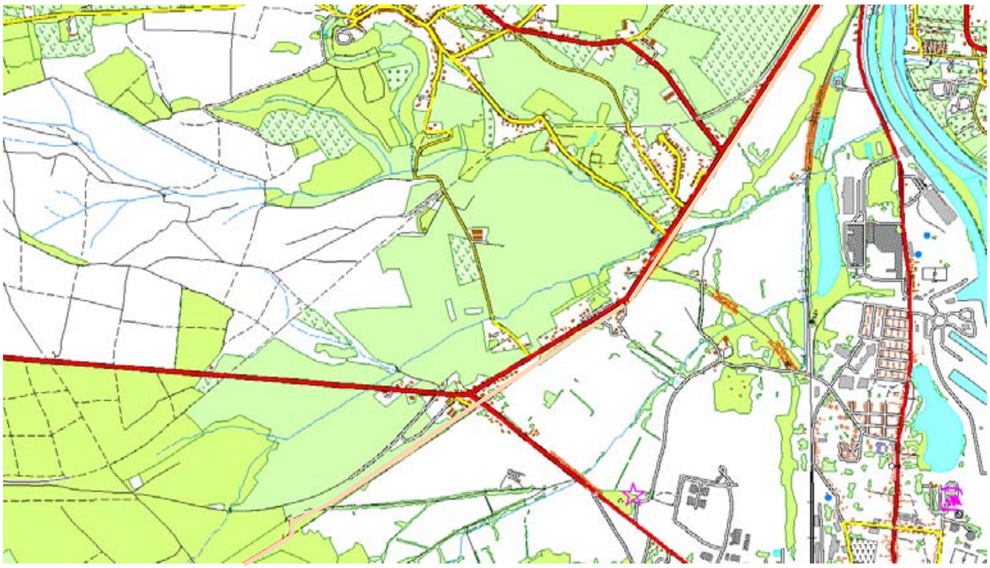

Figure 8. Result obtained on the cross-border tile after exploitation of Belgium data (border in orange).

4. Conclusion

This paper presented a solution to solve problems for cross-border cartography. With an introduction of foreign data in the French DLM by schema translation and edge reconciliation, many problems to obtain the DCM are solved and the cartographic derivation process can be applied. The cartography is the same on the 2 parts of the border, even if some cases must be examined, in particularly for label placement.

In the context of INSPIRE strategy, the data of many countries will be available in the future. The proposed solution which merges the data in a same DLM to produce a DCM will be more usable for cartography in cross-border area.

References

Bader M (2001): Energy Minimization Methods for Feature Displacement in Map Generalization. Dissertation zur Erlangung der Doktorwürde, Mathematisch-naturwissenschaftliche Fakultät, Universität Zürich, 2001.

Barrault M (1998): Le placement cartographique des écritures : résolution d'un problème à forte combinatoire et présentant un grand nombre de contraintes variées. Mémoire de thèse de doctorat en Sciences de l'Information Géographique de l'Université de Marne La Vallée, Marne-la-Vallée, France.

Barrault M, Regnauld N, Duchêne C, Haire K, Baeijs C, Demazeau Y, Hardy P, Mackaness W, Ruas A, Weibel R (2001): Integrating Multi-agent, Object-oriented, and Algorithmic Techniques for Improved Automated Map Generalization. Proc. of the 20th International Cartographic Conference, vol.3, Beijing, Chine, 2001, pp. 2110-2116.

Guislain P and Lecordix F (2011): The ever improving GIS map : evolution of cartographic representations and map production processes – Lessons learnt from the IGN topographic map production project. ICC2011 Paris

Lecordix F, Plazanet C, Chirié F, Lagrange JP, Banel T, Cras Y (1994): Placement automatique des écritures d'une carte avec une qualité cartographique, EGIS/MARI 1994, volume 1, p22.

Maugeais E, Lecordix F, Halbecq X, Braun A (2011): Dérivation cartographique multi-échelles de la BDTopo de l'IGN France : mise en œuvre du processus de production de la Nouvelle carte de base, International Cartographic Conference, 2011, Paris.

Ruas A (1999): Modèle de généralisation de données géographiques à base de contraintes et d'autonomie. Thèse de doctorat, Université de Marne-la-Vallée, France, 1999.