Strasbourg.eu eurométropole

Geographic information for Strasbourg : from historical land register to 3D GIS city modelling

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1. Introduction of Strasbourg

A crossroad located in the middle area of Europe





A cross-border geographical context and a merging point of German and French cultures, due to history

1. Introduction of Strasbourg



Strasbourg Eurometropolis

- Local authority established in 12/31/1966 as the Urban Community of Strasbourg
- Started operating in 01/01/1968
- Became Strasbourg Eurometropolis in 01/01/2015
- The territory (340 km²) is constituted on 33 municipalities members of the metropolis
- The population is 491 516 inhabitants, which represents 43,5 % of the French department Bas-Rhin
- 60% of the population are living in Strasbourg city
- Since 01/01/2015 the President of Strasbourg Eurometropolis is M. Robert HERRMANN





2. A century of land surveying and cadastre





History of the land registry of Strasbourg

1891 : creation of the land survey department of Strasbourg
1890-1918 : production of the "mehrzweckkataster", multipurpose cadastre for the land registre at scale 1/250
1930 : Mapping of Strasbourg at scales 1/4000 and 1/15000
1940-1946 : production of land registry of Strasbourg at scale 1/1000

1968-1988 : Extension of the 1/1000 cadastre to the territory of the urban community





In the region of « Alsace-Moselle », thanks to the local law, the cadastre is not only a graphical document. All the coordinates of graphical elements in the maps can be calculated with the mandatory dimensions written in the land survey sketches.



Setting a new surveying map to improve network knowledge

- 1972 : creation of the "streets and networks committee", a partnership dedicated to improving knowledge of underground networks
- 1977-1990 : the land survey department produces 3200 background topographic map sheets at scale 1/200 and 400 maps at scale 1/500, covering the urban part of the territory

1983 : a regular updating process is commissioned for the background maps

1991 : starting of a GIS project for the Urban Community of Strasbourg (GEOCITY)





3. Implementing a quality GIS for the metropolis

- 1991-1993 : Digitizing of the topographic background maps to build land survey reference data, which will subsequently be continuously maintained and updated
- 1994 : "Streets and networks committee" becomes the "Committee for geographic information in the agglomeration of Strasbourg" (CIGAS)
- 1995-2000 : Streets network reference data are produced along with other intermediary scale mapping data
- 1996 : The "land survey service" becomes "Geographic Information service"
- 1996-2004 : Cadastral maps are digitized then calculated to produce land registry reference data.
- 1998 : First aerial photos covering Strasbourg and Kehl
- 2001 : First experiment with 3D modelling
- 2002 : Strasbourg joins the regional partnership "Cooperation for geographic information in Alsace" (CIGAL)
- 2004 : First full digital orthophoto of Strasbourg and Kehl2008 : starting of the GIS software renewal project (STAR-APIC)



3. Implementing a quality GIS for the metropolis

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GIS as a tool for technical management of the territory

Since the beginning, most of the technical services of the urban community of Strasbourg have been developing a growing use of the reference data provided by the GIS

The high level of quality of the topographic reference data has made them a base for all the technical data of public utilities : transport, water, energy, lighting, waste management, road maintenance, public infrastructure, urban planning...

A few figures for the surveying reference data :

- 3 millions objects covering 185 km² (urban area)
- 85 object classes
- 100,000 changes surveyed every year
- 5 cm precision







Knowledge of the territory for better decision making

2014 : "Geographic Information service" becomes "Geomatics and knowledge of the territory service"

The aim is to develop usage of GIS as a tool for better decision making.

Sociological and economical statistical data complete preciously this information and help us improving our knowledge of the territory and its inhabitants.

Detailed data provided by technical services can be generalized and aggregated in order to build general indicators for the conception and evaluation of public policies.





Knowledge of the territory for better decision making



Marquage au sol : à la commune



4. Looking ahead at 3D and time modelling

The 3D GIS project started in 2009.

The aim is to improve the knowledge and understanding of the territory using comprehensive 3D representations, to prepare the evolution of GIS from 2D data models to 3D and to start working on their uses with all the concerned services.

The DTM was produced by airborne LIDAR acquisition and by autocorrelation from the

photos.





From 2D detailed data to 3D modelling

A semantic model of Buidings has been obtained by photogrammetric stereorestitution of the roofs (LOD2), using the aerial photos acquired for realizing the orthophoto. The 2D geometries of the buildings from topographic reference data were used to obtain the 3D buildings contours.





From 2D detailed data to 3D modelling

In 2013, Strasbourg made a new aerial photo campaign and it seemed useful to acquire not only vertical shots but also images from oblique cameras (45°).
These images were used at first for texturing the facades of the buildings.
Afterwards, it appeared that there could be a secondary product derived from these photos and in 2015 the production of a 3D textured photomesh started.
The result was beyond all expectations.





From 2D detailed data to 3D modelling

The first LIDAR realised in 2008 had shown its limits for processing DTM and 3D modelling.

In 2015, a new high density acquisition was realized (20 points/m²) with full wave return recording and xyz-precision of 10 cm.

This data is an extraordinary source of information for many purposes and the full exploitation of its potential is still at its beginning.





Finally, in order to represents point data in 3D, it is necessary to build some 3D symbols libraries. Those libraries can be more or less realistic. A work is in progress to design specific models for all the street furniture and vegetation in Strasbourg.



Building historical data

The rich history of land-surveying in Strasbourg gives the possibility to create very interesting historical data for land registry.
 In addition, numerous ancient aerial photos are existing on the territory and have been scanned with high resolution.



Such a context has lead Strasbourg to start a project of historical GIS in 2016, in order to study the way all those historical data could be integrated in the GIS.

This step is leading toward a 4D GIS and a knowledge of the territory in the past, the present and the future, with prospective data on the urban projects.



5. Conclusion

Based on a rich land surveying history, the GIS of Strasbourg has achieved a strong level of development and it is widely used among all the services of the metropolis.

It is acknowledged as an essential tool for technical management of the territory and growing as a tool for better decision making.

It is now in an ambitious process of evolution and modernisation that should result with a powerful tool for the knowledge of the territory in all its dimensions.

Other developments are yet in the scope, because state of the art is nowadays in a fast process of evolution.

In terms of data acquisition and land surveying, important technical changes are on the way : the rising use of drones and mobile mapping technologies.



Data sharing is another subject for the coming years, with the combined effects of the implementation of the INSPIRE and PSI directives and the rising of Open Data.

For Strasbourg, the external distribution of GIS data is still a challenging topic. Although much has already been done to conform to the mandatory implementations of Inspire, there is still some work to do in terms of metadata and data visualization and sharing.

Finally, most of the evolutions in progress in GIS data have not been taken into account in the current specifications for INSPIRE themes, aside from 3D buildings and elevation.

The question arises if taking into account 3D photomeshes, point clouds, mobile mapping and time data in Inspire specifications is necessary and how ?



Thank your for your attention

More too see on the GIS of Strasbourg metropolis :

http://sig.strasbourg.eu/

http://www.cartotheque.strasbourg.eu/