

# A PROPOSAL OF REGULATORY STANDARDS FOR CADASTRAL MAPPING IN BRAZIL

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## **Abstract**

Cartography activities in Brazil follow the regulations standards of Decree – Law 243, of 1967. However, they are limited to issues like land, theme and special systematic mapping, the largest scale being 1/25 000.

To date, despite the advances in treatment and use of geospatial information, there is a lack of regulatory standards for larger scales, particularly those adopted for the cadastral mapping.

The lack of official regulatory standards for mapping in cadastral scales results in different and often improvised specifications, not appropriate for the purposes intended, especially in municipal cadastres, creating conflicts of all kinds such as geometry, file formats, systems, limitations of use, geodetic data and non-appropriate technological input.

The Cadastral Mapping is essential to the databases required for the development of the Municipal Master Plan, and the background of a variety of thematic maps, representing the physical, socio-economic, urban and geoenvironmental settings. The need to implement basic mapping regulatory standards can be explained, once more, by the relevance given to these maps. Moreover, modern technologies of Geographic Information System - SIG, Global Positioning (GPS), Remote Sensing Imaging, collection and processing of data, as well as databases highlight the need for proceedings that are consistent with the features available in these technologies, which reinforces and justifies the development of Cadastral Mapping standards. The municipalities urgently need regulatory standards for hiring Cadastral Cartographic Surveys, in order to dispose of geographically located municipal information, and to carry out Master Plans and development programs without harm to environmental preservation. Such surveys are also crucial, regarding the requirements of administrative and tax modernization programs, as well as the Fiscal Responsibility Law.

To handle such a task, a committee has been assigned within the National Cartography Commission – CONCAR (collegiate body, coordinated by the Ministry of Planning –

responsible for the National Cartographic System – SCN), with representatives from various public and private business segments. The purpose of the Committee's works described in this paper consists of surveying, designing and assembling norms and standards for the Municipal Cadastral Mapping, for cadastral scales, equal or greater than 1:10.000, including urban areas, areas in process of urbanization, rural areas, subnormal settlement areas (slums), and areas meant for municipal infrastructure pre-projects.

Gathering information from official regulatory standards existing in other countries, as well as regulatory standards adopted by Companies and/or Organizations in Brazil who hire these services and make use of them, the Committee shall create and consolidate these regulations which, after being discussed, shall be made available for public consultation, in order to allow the participation of the whole community who produces and uses this mapping scale.

To date, the Committee is creating a preliminary version by dividing the tasks into Modules, which seek to address all issues to be regulated.

After the conclusion of this work, the regulatory standards shall be approved by the competent bodies and shall be made available to the Brazilian society.

## **1. Introduction**

In recent years, the recommendations concerning the need for regulation of cadastral mapping have become more evident, emanating from various events and internal debates from the organizations who produce and use such information.

The demand, observed due to the urgency of vectors that allow for administrative modernization of cities, such as those based on information related to the geographic space, in addition to requirements found in actions of the municipal integrated planning and management and, finally, by the absence of a technical body to coordinate mapping activities focused on municipalities, the National Cartography Commission – CONCAR decided to incorporate this matter in their agenda.

Then the opportunity to put the issue under discussion arose, which resulted in the creation of a special committee, which subsidizes CONCAR, with a specific focus on the development modern specifications for Cadastral Mapping.

Accordingly, CONCAR organized a round table during the last National Conference on Geography and Cartography – CONFEGE, held in August 2006, where public organizations and business representatives from the private sector had the opportunity to present strong arguments about the need for such regulation.

At the end of the event, the creation of this committee was recommended, and officially established in November 1<sup>st</sup>, 2006, during the 10th Session of CONCAR, held at the Ministry of Planning, Budget and Management - MP in Brasilia.

A Coordinator for this Committee was appointed, and the organizations that should participate were suggested by those present, with the appropriate adjustments during the works.

The focus of this work in the first stage is the *municipal cadastral mapping*, therefore, although it might present coincidences, there shall be no focus on organizations that, according to the characteristics of their activities, already have regulations for surveys, also called cadastral mapping. We can include, as an example, among these organizations, those exploring and managing oil systems, mining, concessions, land settlement, port systems, logistics, telecommunications, distribution of electric energy, hydro-agriculture complexes, among others.

Moreover, at first only the space component shall be regulated, that is, vector mapping, orthophotographic mapping, topological structure and management criteria for the space component. The cadastre component itself shall not be addressed at this moment. To this point, it is not clear how, when or by whom the cadastre regulation issue shall be handled, as there is none in Brazil.

## **2. Objective**

To propose regulatory standards for cadastral mapping, so far nonexistent, supplying the municipalities and other government bodies that are responsible for production/hiring of services, use and management of information related to urban and municipal infrastructure.

The Committee's works consist of surveying, designing and assembling norms and standards for the Municipal Cadastral Mapping, for cadastral scales, equal or greater than 1:10.000, including urban areas, areas in process of urbanization, rural areas, subnormal settlement areas (slums) and areas meant for municipal infrastructure pre-projects.

The Committee's guidelines are:

- ✓ To research, analyze and consolidate existing initiatives and regulatory standards in the national and international market regarding regulatory standards and technical specifications for these scales.
- ✓ To present to the society a proposal for regulatory standards consistent with existing needs and regulation in use.
- ✓ To advise CONCAR through guidelines and recommendations for guidelines on regulation for cadastral mapping.

- ✓ To contribute to other committees and sub-commissions of CONCAR.

### **3. Methodology**

#### **3.1. Direct and indirect benefits resulting from the elaboration of these regulation:**

- ✓ Regulation nonexistent to date, regarding the development and management of Cadastral Mapping in detailed representation scales of geographic features and urban and municipal infrastructure networks.
- ✓ The practice of different and often improvised Cadastral Mapping specifications shall be eliminated, for they are, frequently, not appropriate for the purposes intended, especially in municipal cadastres.
- ✓ Conflicts of various kinds in Municipal Cadastres shall be abolished, especially those related to geometry, file formats, systems, limitations of use, geodetic data and non-appropriate technological input.
- ✓ Possibility of preparation and use of integrated databases for the use of a single geodetic datum, SIRGAS2000. The new datum, SIRGAS2000, shall provide a consistent and accurate national datum for all geospatial applications.
- ✓ The implementation of these specifications shall result in the background for the composition and use of the necessary databases for the preparation of Municipal Master Plans, consisting of a variety of thematic maps, representing the physical, socio-economic, urban and geoenvironmental settings. The need of technical specifications for the execution of basic mapping can be explained, once more, by the relevance that is given to these maps.
- ✓ There shall be an effective reconciliation between survey procedures and functions available and in development, relating to modern technologies in Geographic Information Systems – GIS, Global Positioning, Remote Sensing Imaging and assembly of Geo-positioned Databases.
- ✓ The municipalities shall be provided with regulatory standards for hiring cadastral cartographic surveys, in order to dispose of geographically located municipal information, in order to carry out Master Plans and development programs without harm to environmental preservation.
- ✓ Such surveys shall provide supporting technology tools regarding the requirements of administrative and tax modernization programs, as well as the Fiscal Responsibility Law.
- ✓ Integration of geospatial data for the construction of the National Infrastructure of Geospatial Data.

#### **3.2. The positioning of the cadastral map in the municipal information system:**

One of the most obvious trends is that the municipalities need a single Georeferenced Database, where all government agencies will be users, each making use of the

database, according to their needs and operational demands and, therefore, it is essential to make use of a single geodetic datum, in the case of Brazil, SIRGAS2000.

The quantity of thematic axis that can be listed in a city is huge, but all of them, without exception, should interact with the single database through municipal management support geoprocessing tools; these tools are based on features existing in most part of the geoprocessing software, or are customized for each user. These considerations lead us to the fact that the local environment is one of the most favourable to the establishment of a Geographic Information System – GIS, which should be integrated into the Municipal Information System. The Cadastral Map has, thus, an extremely important role in this environment, because it is the background or the foundations of alphanumeric, tabular and textual information.

As a result, we should examine two specific topics from this Information System: the first one deals with the complexity in the assembly, management and use of Municipal Databases; the second one approaches the identification of the focus of the specifications to be proposed.

### **3.3. Considerations on the degree of complexity in the assembly, management and use of municipal databases:**

For better visualization of the topic, we should study and analyze the operating diagram below. It is necessary to emphasize at this time that, unlike what might happen in a few state capitals, in most City Halls there are collections of data in absolutely no condition to integrate, immediately, a Geographic Information System. These data, however, cannot be disregarded and shall constitute the root of the information that integrates the database in the future. There is real estate, property, legal, historical, supply, social services information and other types of information. There is also graphic content regarding Master Plans prepared, previous land division projects, districts situation, blocks, lots, buildings, public works, risk areas, tourist areas and others. Some cities have maps, most of the time outdated and made without technical specifications. We could even believe that everything would be resolved by building a new and modern Cadastral Cartographic Base according to technical specifications; but we know that this is not true, as abandoning what already exists would make the administrator feel insecure and hesitant to decide for the use of new technology. Therefore, we should give the theme a more holistic view, even if the specification proposals are directed to the Cadastral Base.

### **3.4. Identification of the focus of the specifications to be proposed:**

In Figure 1, we find the Municipal Cadastral Map as the core of the Information System, being the focus of this work and, in Figure 2, its connection to the databases that shall feed it and with potential users.



Figure 1 – The municipality’s map as a focus

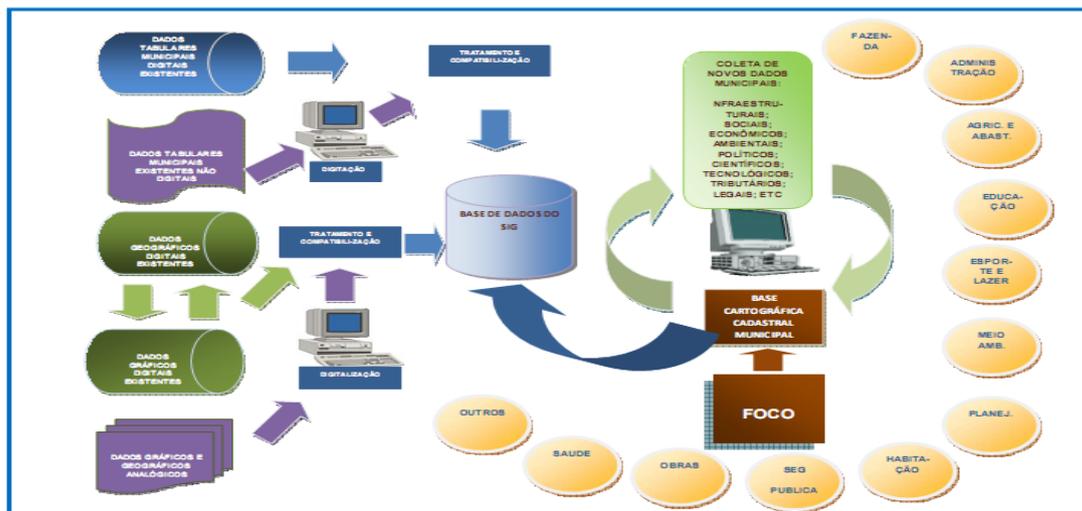


Figure 2 – Relation of the Municipal Map with the Databases

### 3.5. The cadastral map as one of the direct vectors of the municipal sustainability:

The detailed and accurate knowledge of the Municipality is fundamental and essential to the planning. There is no way to do it without structuring and putting in operation reliable information on urban and rural components.

The planning, as well as the implementation, needs the cartographic representation of this information and its attributes. Outside of these conditions, there shall be no sustainability for any program, including the Master Plan for Sustainable Development,

the Municipal Collection, the provision of Essential Public Services and Technical Social Work Projects.

### **3.5.1. The master plan for sustainable development:**

The preparation of the Master Plan for Sustainable Development of the Municipality requires maps of various sorts, due to the diversity of topics to be presented. As a cartographic base, it is necessary to prepare two types of mapping: one, immediately, for the entire municipality; and another one for resulting projects, in timely occasions, on urban and expansion areas. At that time, the Geographic Information System should be structured, as the Master Plan, once approved, shall require the preparation of Projects, implementation of works and monitoring. In Figure 3, there is an example of urban digital map.

### **3.5.2. Municipal collection**

This subject is generally difficult to address at the City Halls, due to the lack of guidance on the procedures to be followed so that the results are satisfactory. There are occasions when the property re-cadastration is made based on poor and outdated mapping information, or even without such information, counting only on tabular data. There are also cases where the sources of the mapping are images not consistent with the degree of resolution required for the cartographic detailing of the collection process elements. The Property Value Map can only be reliable if the vectors related to it are up to date and available. The only way to achieve favourable results is to make the cadastral cartographic base of urban areas and urbanization, otherwise, the cadastration of property will not be supported. In Figure 4, there is an example of the Digital Urban Map with the cadastration of the taxpayer involved.



Figure 3 – Digital Map



To achieve this, it is essential to build Cadastral Cartographic Bases, in some cases, on scales larger than 1:2.000.

### **3.8. Lines of action**

Soon after the establishment of the Committee under CONCAR, a meeting was held where, after several discussions and proposals, it has been decided to hire a company that would create a regulatory proposal that would be delivered to the Committee. This decision was taken by the group to speed up the process and make the regulatory standards available to the society in the shortest time possible.

The process was held within the rules of the Federal Government, where a public bid was made in the form of electronic bidding. The Committee prepared this bid, where all the criteria that should be included in this regulatory proposal has been established .

#### **3.8.1. Regulatory proposal**

In this first stage of the Committee's works, after the preparation of the bid and determining the winning company in electronic bidding (December/2008), the efforts focused on monthly meetings with the company that was developing the regulatory proposal, verifying whether all the requirements made at the bid had been met, suggesting adjustments, checking the deadlines and quality of every work.

In order to facilitate the implementation and monitoring, the content was divided into Modules and the implementation schedule was set for a 5-month period.

For each of the modules, there was a description of processes, methodologies, suitability, precisions, geodetic systems, cartographic projection systems, equipment, hardware and software.

#### **Description of modules and methodologies:**

##### *✓ Search of Existing Data and Trends Module*

An extensive research was made on the theme proposed in this document, in national and international bodies and companies to produce a report of current trends.

In the case of companies or international organizations, the survey contains names and contacts, existing and available documentation, sites/links, product types and ways of dissemination.

##### *✓ Acquisition Of Inputs Module*

##### *✓ Digital Vector Mapping Module*

##### *✓ Digital Vector Mapping Through Orthorectification Module*

##### *✓ Topological Structuring Module*

✓ *Management Criteria Module*

The technical attributions shall be defined by conservation and distribution of the cartographic base by the various segments and permanent or sporadic updating specifications of the cartographic base created: Instructions for technical training of professionals.

**3.8.2. Current stage and perspectives:**

By the end of 2009, the Committee shall focus its efforts on consolidating the existing materials produced both by the company hired and by members of the Committee, in the several research and studies being conducted. Numerous meetings for the discussion and closure of these texts shall take place.

After consolidating the group, the document shall be forwarded to CONCAR, so that it is sent Plenary and then made available for consultation and public hearing. There shall be a new round of group discussions and consolidations, and then the document shall finally be available to society.

**4. Results**

The work of drafting the proposal was completed in July 2009 and, since then, the Committee has been meeting in order to consolidate the document and make the proposal become a regulation. The proposal submitted by the company served only as preliminary material for consultation to facilitate and expedite the work of the committee formed by professionals from various public organizations and companies. These professionals are committed to this work as volunteers, dedicating their time and resources so that all this work could become a reality and benefit the entire Brazilian society.

Several other documents are being researched and professionals are being consulted, in order to have all this consolidated in 2009 and to be sent by CONCAR to the consultation process and public hearing. In addition to the regulation, at the end of the work, other parallel studies that have emerged during the course of the work shall be made available to society.

**5. Conclusion**

It is worth considering here the importance of spreading a new culture, which is the upgrade of the municipal cadastral map. It is very rare to find this mentality on the part of the City Halls, although this will be the wish of technicians who remain in their functions during the change of government.

One thing that could be verified in municipalities is the use of very old maps that no longer represent the city today. In many cases, there are even accurate municipal maps,

but with absolutely outdated information. There are cases of municipalities that developed Master Plans that included maps of many years ago. Another aspect that needs to be highlighted is that the municipal cadastral map is now the spatial component of a georeferenced database. It is not possible, therefore, to geoposition new components on missing or outdated spatial attributes. The goal of the Management Criteria shall be to establish procedures for updating cadastral databases developed, aiming for the conservation and constant upgrading of the Database.

It is important to emphasize that several other issues could have been addressed within that context. The lack of regulations for this and other related subjects is huge, however, the focus on municipal mapping and also the option of speeding up the work with extra help, although always questioned by some, spectacularly helped us have a more dynamic work and make the material available to the society in one fifth of the estimated time.

It is expected that this regulation fills the gap regarding this matter and that other similar initiatives can be originated from this one, generating equally useful works to the Brazilian society.

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