

# **Overview of Transmission Lines Integrated with Land Cadastre in Brazil**

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**Key words:** Cadastre; Land management; Transmission Lines

## **SUMMARY**

Geographic information is considered, day after day, a fantastic resource for decision making, in special way, this sense has been increased for some corporations which are involved with the electricity sector. Thus, their performances are related with basic needs for everyone, this mean “energy”. According to the principles of land cadastre, the efficient management of geographic information for Brazil is almost blank, besides the electricity companies recognizes the great value of mapping and monitoring of land changes/uses. In such situation, this paper focuses on the role of the cadastre, aiming to characterize the situation of deployment and development of Transmission Lines in Brazil, involving legal land systems, and significant local facts. In this way, this research enhances the importance of an efficient cadastral data administration for electricity facilities, aiming to get optimize territorial management, and raising the cost reduction for a developing country.

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## **1. GEOPROCESSING**

The availability of spatial information is the starting point for decision making. For the management of specific enterprises, as these involved in the process of energy transmission, is, without a doubt, indispensable the knowledge of the geographical space where it is applied.

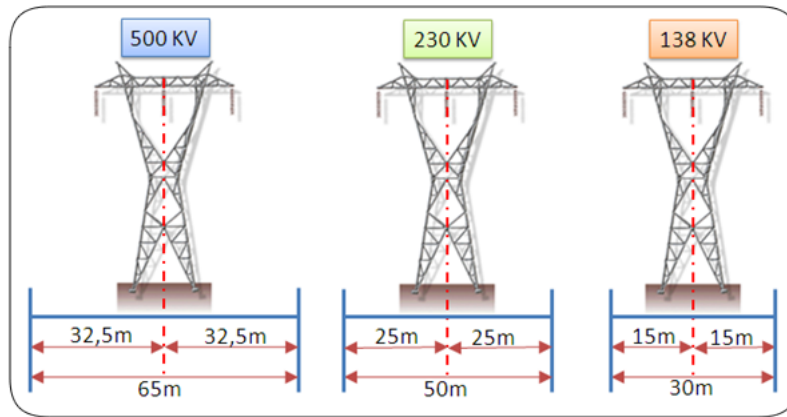
One of the advantages of working with the GIS platform is having the agility in the data consultation that is linked to the space. This way the Companies of Electric Energy can perform the surveying of the properties, towers, lines and proprietors, with more agility once the data is directly related with the spatial location.

Geotechnologies, such as geoprocessing and remote sensing, are important tools that are changing the quality of the results facing the decision-making and strategic planning. Mapping, analyzing and interrelating biotic and abiotic factors are characteristics belonging to the professionals that work with multidisciplinary segments. According to Loch (1989), multipurpose technical register analyzes multiple areas of integrated form, in such a way that the user can extract a great volume of information of a region where mapping is arranged in the standard of the surveying. Currently, the professional that works in the area needs to act differently and adopt a profile that presents characteristics that assist the demands of the market.

## **2. PERFORMANCE**

The Strips of Servitude, also called the strips of safety, are defined corridors below where the electric energy transmission lines pass. Those corridors have a determined width in function of the type of Transmission Line (TL), in other words, according to the tension that is transmitted by the cables, and they are installed with the function of establishing an area of safety to the population. From the construction of the transmission lines, the proprietors of the land below TLs, have restrictions for the use of their land, depending on the need of maintaining the people's safety, avoiding sinister, and possible problems with the lines. The servitude strip does not alter the limits of the rural and/or urban portion, it configures them just as a concession of use, however, it modifies the value of the land and its potential use. In Brazil the width of the servitude strip is determined in function of the calculations

and established parameters by the Brazilian technical norm entitled: ABNT NBR 5422, that takes in account the balance and deflection of the cables, the electromagnetic field, audible noise exercised by the tension, interference in the radio waves, etc. Example of the existent variability among the widths of strips of safety is according to the specifications of ABNT NBR 5422, is shown in Figure 1.



**Figure 1** – Sketches of the width of the Strip of Servitude according to the tension.

The safety corridors are not visible to the proprietor of the portion, once they are areas ordained by a normative technique, in function of a perpendicular distance to the axis of the TL. Despite of there not being physical demarcation *in-loco* that aids the proprietor in that identification, the use of the land around the strip of safety is of restricted character.

### 3. PROBLEMATIC

The irregular occupations along the Brazilian TLs become aggravated and they come more frequently, mainly with the urban expansion, that occurs without the control of the public power or the administrative agencies of the Brazilian electric system. The state has difficulty in controlling that type of infraction, since the mapping of the country in great scale and, for correlation; the Brazilian territorial survey is not consolidated. Figure 2 shows an example of the noncompliance of safety's norms in the municipal district of Palhoça, SC, which illustrates the irregular use of the servitude strip for the habitation. The use of satellite images of high resolution enables a diagnosis in visual scale, could be done with low relative cost, in function of the distance traversed of the TLs, making the constant updating of the databases still possible, and the observation of the evolution of the picture of the area of interest, as can be seen in Figure 3. The individual characterization of the plot, or even their legal limits are far from being identified in images of high resolution, therefore the national situation is

characterized on this side of a territorial register systematized the disposition of the concessionaires of energy. This situation configures the difficulty of planning and management as for the restricted use of the plots, once there is the need, on the part of the linked companies to the electric sector, to utilize the space for towers and TLs, and that by the absence and map surveying, it incapacitates the regularization or territorial reorganization of the safety's strip.



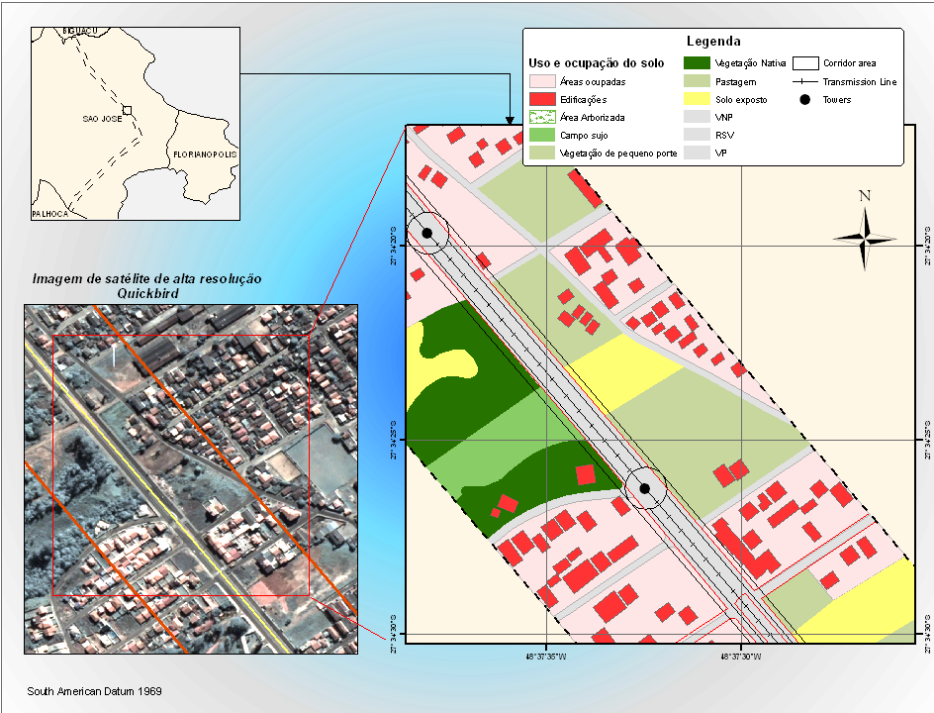
**Figure 2** – Irregular construction close to a strip of servitude.

The Brazilian territorial register is still in the embryonic phase and the lack of information regarding the limits of properties, rural or urban; they are incapable to stop the need of expansion of the transmission lines in the country.

Blachut (1974, apud Girardi, 2003), considered that in an organized society the existence of the register is indispensable, because the state as much as society depends on it. That means that the state should possess a registration of the proprietors or users of the soil with the purpose of managing the territory and their resources. The society needs a clear definition of the limits of their properties for the effective protection of their rights.

The technical register is important for: planning of projects of new TL's, compensation calculations, territorial reorganization, among so many other factors; it is not possible to expect that

the georeferencing (register) of the properties will be carried out to continue with the progress of the transmission of energy.



**Figure 3** – Mapping of improvements and use of the soil surrounding the TLs.

The total absence of cadastral information that gives support to the decision-making in the patrimonial and environmental management of the corridors of the transmission lines presents itself as a limited factor in the planning actions and management of the concessionaries of Brazilian energy. According to Karnaukhova (2000), adding anthropogenic information, natural and legal about the territory, the cadastre permits the data to transit without duplication and crossing of administrative and technical information. It is necessary to evaluate the enterpriser’s needs, to establish the methods that will be used, in a way to minimize the costs and the time of work, giving emphasis in the qualification of the professionals involved in that area of performance, so that the updating activities are continuous and self-sustained by the companies.

**4. DOCUMENTATION REGARDING THE TLS**

The Patrimonial Partner Management System (SGSP), is a document guideline that has the objective to establish politics and strategies for the performance of the Concessionaries of the Electric

Sector in Brazil. It also emphasizes the management of the areas of property of the concessionaire or of the servitude, in order to look for uniform procedures as for the preservation and administration of the property patrimony. This document is one of the few government guidelines that detach the patrimonial question and search to create standards for the use of the areas of strips of safety in reservoir areas and/or lines of electric power transmission.

The SGSP emphasizes not directly mapping nor the cadastral survey, but may points raised in the document may be directed to applications in Geographic Information Systems or the generation of printed maps. The patrimonial information for the interest of the concessionaires, as is the case of the servitude strip, is directly connected with the property boundaries, but the lifting of the limits of the plot is not the responsibility of the electricity sector. Given this contradiction, the SGSP tries to propose a feasible way to minimize this problem facing the continuing need for energy generation and distribution throughout the country.

## **5. REGISTER AND THE ELECTRICITY SECTOR**

The expropriation and compensation of the servitude are integral stages of the process of implantation of a TL. Thus, reliable information concerning the territorial register, on which the project will be implemented, will contribute to:

- Compensatory calculations;
- Appraisal efficient total cost of the project;
- Satisfaction of agreements for use and occupation of the territory between the company and owners;
- Possibility of territorial (Re)ordering, following the principles of planning and land management;
- Reducing costs with teams of topography/geodesy, optimization of survey work;
- Efficient Asset Management by utilities in the electricity sector;
- Compliance with the laws of environmental protection;
- Among others.

In Brazil, in 2001, the Law 10.267 was instituted mandating the georeferencing of rural property ownership by consolidating the title and the geometry of the plot, ensuring the right of ownership.

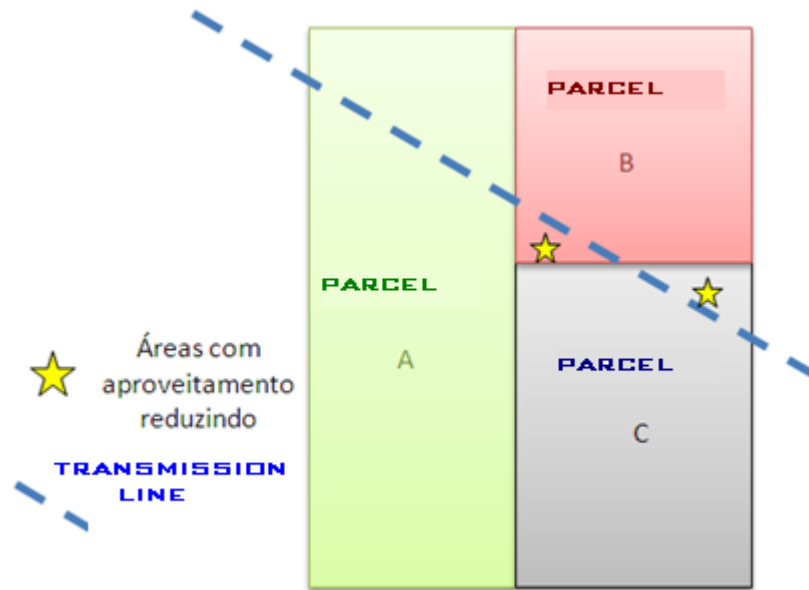
Despite this encouraging regularization, the country still walks in slow steps in the practical implementation of this proposal, which reflected negatively on the cost of engineering evaluation. Thus, the concessionaires of energy end up doing the cadastral survey of areas affected by development, generating plants of registration only real limits (limits of respect) rather than legal to protect the designing compensation. This produces a series of conflicts such as:

- The responsibility of the Concessionaire of Electric Energy to define the boundaries between the parcels;
- Necessity of the owners of the parcels are present at the time of survey defining the limits;
- Inconsistency between the registered areas (legal) and raised (real);
- Identification of the right Proprietor or of the lease holding proprietor.

As a consequence of that action, there may be greater resistance from the affected population, hindering the progress of the execution or initiation of legal remedies to recover the status of implementation of the project.

Emphasizes the acquisition (right of way) of the strip of servitude by the Electric Energy, more specifically in the form of use concession. This procedure makes the strip of servitude have restricted use and, therefore, unprovision sometimes the use of the geometric/spatial envisioned before by the holder of the plot. Associated with this situation there is still a need for access to the towers of the TL, and once again the portion to be divided or otherwise “framed” in their use and/or potential use.

According to the situation in which the owner of the plot made the implementation of the TL (as built), the geometric reconfiguration features a new use of the potential use of the soil. In reality, suggesting a physical break in the continuity of land use and therefore the plot is “virtually” to be broken, so there is sometimes strengthening the sale of one of the parties. Figure 4 illustrates a sketch showing the example.



**Figure 4** – Passage of TL on elements causing a loss of use depending on the geometry of the boundaries.

Once the features are quite heterogeneous in existing cases, the sale of the split parcel (as land use) occurs in the informal context and, thus, becomes an element that behaves as inhibitor in the process of land regularization since that these transactions occur between relatives and/or friends, or in the condition in which the square footage is to be irrelevant in the design of the parties that signed the agreement. Again the process is configured as a contract “drawer” or procedure in which there is the commitment of “word”. The principle of Territorial Reorganization contributes to attempt to solve these kinds of impasses in order to promote a better use of geographic space.

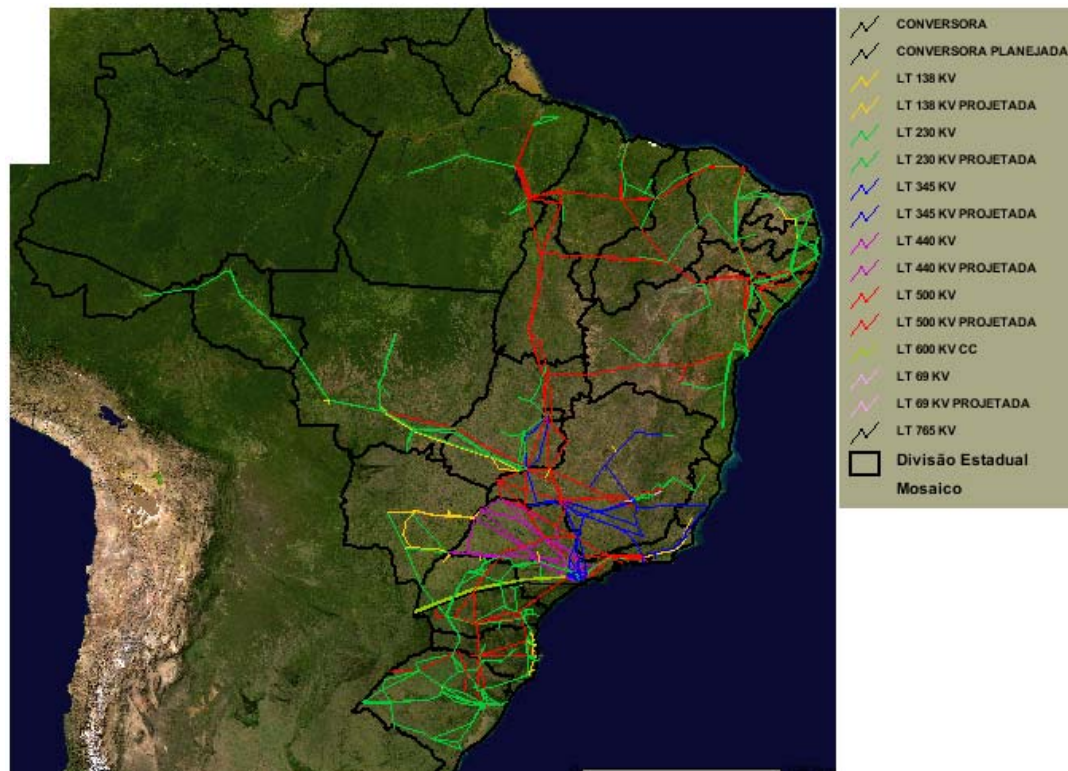
## 6. CONCLUSION

Geographic information is a valuable resource for decision making in various areas and therefore, their production and use have grown significantly. However, the practice due to the high demand for geographical information of TLs, have their efficient a little rendered. In a country with hundreds of kilometers of TLs, as shown in Figure 5, it is important that the country invest in:

- National mapping in a great scale;
- Creation of a federal agency managing the land registry;
- Effective national policy to guide public and private companies, especially in the setting of Standards to support the registration deployment and management of land registry;



- Training and building of professionals with expertise in territorial registry, especially aware of the demands of utilities focused on the electricity sector;
- Creation of an integration policy between the registries, legal and real at the national level;
- Standardization and definition of national parameters for integration of the cadastral database.



**Figure 5** – Transmission Lines of Brazilian Electric Energy - Source: ANEEL (2010)

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## **BIOGRAPHICAL NOTES**

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