

Do-it-yourself Determination of Cadastral Boundaries: Will GPS make it happen?

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ABSTRACT

Global positioning (GPS) has a major impact on the determination of cadastral boundaries. GPS-technology in principle enables parties to measure the boundaries themselves. The surveying and mapping are further facilitated by consulting and obtaining information using Internet technology and intelligent mapping software. Is there still a need for cadastral surveyors and what will be his or her future role? The paper addresses technical, institutional, and legal aspects that contribute to the changing role of the cadastral surveyor. The role of the surveyor is discussed in relation to the FIG-statement on the Cadastre. To a certain extent do-it-yourself cadastral surveying will happen. Its introduction is, however, strongly influenced by the legal system, the role of the Cadastre and cultural aspects.

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1. INTRODUCTION

Imagine you are enjoying a barbecue with your neighbours. In this pleasant setting your neighbour unfolds his plans for his new shed in the back garden. To erect it, he needs to build on your property. A couple of months ago you already agreed to solve this problem by exchanging a piece of property. Walking along your common boundary you decide to settle the issue at once. You hurry back in to fetch your internet-enabled communicator. Returning with it in the garden you start the property transaction program. The program guides you through the necessary steps to prepare the transaction. The program shows you the current situation. Once you have indicated on the screen where the new boundary should be situated, the program instructs you how to locate the new boundary. Being GPS-enabled your communicator records the new boundary points. You close the protocol and your transaction is submitted to the notary of your choice and the land information office. Tomorrow you will look if the transaction can be executed, and if so you will receive the legal (digital) documents in a few days time, after the legally required time of reflection has past. Having completed the job, you and your neighbour walk back to the barbecue party to look if the steaks are ready.

The future will learn whether such a scenario will materialize. It is important to realise that the enabling technologies exist. Another issue is whether (or rather when?) the legal system and the institutional context will allow such a scenario. The role of the cadastral surveyor will be affected, whatever happens.

In this paper we will discuss the impact of technology, and in particular GPS, on the role of the cadastral surveyor. We will consider the issue from different points of view, as technology is only part of the issue. The purpose of this paper is to contribute to the discussion on the future role of the cadastral surveyor.

2. STARTING POINTS

There exist different types cadastres. The surveys published by the English Land Registry (1998, 2000) provide a good overview of aspects as the public availability of data, the type of boundaries (e.g. fixed or general boundaries), the way of recording them and the type and method of maintenance of the cadastral map.

Despite all these differences there exist some general trends in the evolution of cadastres (see (Kaufmann and Steudler, 1998) in their publication on Cadastre 2014). Some of these trends are technology driven. Also in future there will be differences between cadastres and thus

differences in the role of the cadastral surveyor. The impact of technology drivers on the role of all cadastral surveyors is similar however, because many tasks of the surveyor are technology-based.

3. TECHNICAL TRENDS

It goes without saying that GPS has a large impact on the land surveying aspects of cadastral surveying. For the surveyor GPS may strike the eye as the most important technical development, but actually there are a number of important technical developments that have an impact on cadastral surveying.

GPS influences the way the field surveys are executed. The following are important aspects:

1. GPS-surveying requires less technical expertise than traditional surveying. The software guides the user; understanding the underlying measuring principle is not necessary. The surveyor only has to take care of his own roving receiver (data-terminal). Increasingly public or private reference networks for precise GPS-real-time positioning are available. The GPS service-providers may also perform part of the data processing.
2. Quality assurance of the surveying process and results should be oriented towards GPS. GPS is a very precise measuring technique, but accuracy (comprising precision and reliability) is not automatically warranted. The generic quality requirements concerning cadastral boundaries are not (or should not be) dependent on the method of data capture. Sometimes GPS users tend to forget that precision does not automatically imply accuracy.
3. GPS is coordinate-oriented. Results are by default available in a global reference system (or a continental, national or regional reference system that is linked to the global reference system). These coordinates are operational in the sense that they can be reproduced (even over long time spans). This requires a GPS-infrastructure firmly rooted in the national spatial data infrastructure. GPS will strengthen the tendency to record boundaries by means of coordinates.

In many cases other techniques (photogrammetry, tacheometry, or measuring tape) will still be efficient methods of data capture, but GPS will become the default technique of data capture for cadastral updating (certainly in rural areas).

Besides GPS the following technical aspects influence cadastral surveying:

1. Cadastral maps are available in digital form. In many cases the cadastral maps are object-based. With proper software the user is guided in the updating of the cadastral map. The mapping of the surveying results is increasingly facilitated by software and results in less user-involvement.

2. The data required to perform a cadastral survey can be made available in real-time during the survey. Network technology enables real-time dissemination of data required for updating.
3. Besides GPS new data capture techniques are being developed. Digital (terrestrial) imagery enhances and expands the methods of data capture and the recording of results. Possibly an edited picture might replace the classical field sheet.

Probably the first two items will have even a larger impact on the work and working process of the cadastral surveyor than new techniques of data capture and in particular GPS. Besides they will have a major impact on all elements of property transactions.

GPS, its low procurement costs, and the increasing availability of data allow the layman to check or resurvey the cadastral boundary. In general the cadastral surveyor will meet a more critical property holder. His surveying becomes less of an art and will rapidly become more transparent.

Overlooking these developments do-it-yourself cadastral surveying is feasible from a technical point of view. In the next paragraphs we will see if it is desirable from the point of view of the parties involved in the land markets and the cadastre.

4. POINT OF VIEW OF PROPERTY HOLDER

Most individuals rarely operate in the land market and deal sporadically with the cadastre. The number of real estate transactions they are involved in is limited (a few in a whole lifetime). Most property holders are subject to taxing and planning activities which may be based on cadastral information, but which are seen as activities of the responsible authorities. They thus generally have a limited knowledge of the cadastral concept of parcel and the types of boundaries (e.g. fixed versus general boundaries).

In executing real-estate transactions they are generally advised by professionals such as real-estate agents, notaries, solicitors, and (cadastral) surveyors. Generally property holders seek long term legal security for their established rights, which for them generally represent a large interest (economically as well as emotionally). For the property holder transparency of the legal situation, access to information and simplicity of working procedures are important. They require quality in relation to the standards in their society, the legal system, and the land market (e.g. the boundaries are determined with an accuracy in accordance with land value). It is of primary importance to the property holder that the boundary is recorded in an independent manner and the information on its location is secured. Do-it-yourself cadastral surveying is not one of the primary objectives of the property holder. Cost is of relative importance, as long as it is reasonable related to the level of legal security and the value of the property.

In the Netherlands particularly the legal security and the rapid execution of transactions are important. We see, however, that the property holders are becoming more critical with respect

to the services offered by the parties in the land market (among which the cadastre). They demand value for money. Also the cadastral surveyor should justify his added value.

Nowadays property holders can and will check information on the legal status and the location of their rights. In that sense we increasingly see parties checking cadastral boundaries by comparing them to large-scale topographic maps. Is remeasuring a boundary by GPS the next step?

5. INSTITUTIONAL ASPECTS

Kaufmann and Steudler (1998) extensively discuss institutional trends concerning the cadastre. Although cadastres will also differ in the future, they foresee the following general aspects related to geometry:

1. Cadastres will register (and thus locate) all legal land objects (originating from private and public law).
2. Data capture and mapping will be digital.
3. The cadastral map will be an intrinsic part of the cadastral registration (i.e. the division between the administrative and geometric part will disappear).
4. Cadastres are based on fixed boundaries located by coordinates.
5. Land objects are registered in a common reference system.

GPS is obviously one of the instruments to make these aspects possible.

Institutional changes of the cadastre will certainly be based on cost-benefit analyses. The ideal cadastre should operate cost recovering. This will lead to the investigation of efficient procedures in property transactions and land information. These considerations will affect the working procedures of all parties in the land market. The scrutinization of the procedures of surveying and recording cadastral boundaries will mostly affect the cadastral surveyor. This will result in more effective procedures, but maybe also the different roles of the parties involved.

Obviously these changes are not only driven by efficiency issues, but also by the technological developments and developments in the land market (such as more critical property holders).

6. ROLE OF THE CADASTRAL SURVEYOR

The surveyor is attributed six (possible) roles in the FIG statement on the Cadastre (FIG, 1995), namely: cadastral surveying, survey recording, land valuation, land-use planning, database management, and dispute resolution.

Cadastral surveying and survey recording (although to a lesser extent) are affected by the use of GPS. Cadastral surveying comprises:

1. Definition;
2. Identification;
3. Demarcation;
4. Measuring;
5. Mapping.

of new or changed legal parcel boundaries. Sometimes this process includes the re-establishment of lost boundaries and the resolving disputes over boundaries. In most countries either licensed private surveyors or government officials carry out cadastral surveys. The legal system and the type of boundaries define how involved the cadastral surveyor is in these steps.

Surveying is made easier by the fully digital data capture, maps, and data processing techniques. Furthermore GPS and intelligent mapping software require less user's knowledge of the measuring and mapping process. The surveyor will increasingly have to justify his or her added value. He may even encounter competition from other professionals. If there exist clear guidelines on the definition, identification, and demarcation of boundaries the role of the surveyor could be point of discussion.

The cadastral surveyor has, however, a number of unique selling points. Firstly he *independently* surveys, maps and records the boundary. The surveyor is not involved in the property transactions. This is an important aspect in maintaining legal security. Secondly, he is generally the only professional who oversees and can execute the whole process of surveying and recording. The surveying and mapping of new boundaries is not a technical issue anymore, but a proper recording of boundaries requires cadastral insight and an overview of all aspects of legal land objects. Furthermore specialised knowledge is required if boundaries have to be re-established.

The role of the cadastral surveyor will change from that of a technician to an adviser to parties on legal land objects in general and in particular boundary definition, identification, demarcation and recording. Parties need to be advised on what constitutes a boundary, and which existing information and rights have to be taken into account. See (Maynard, 2001) for a nice example. Recording will remain an important task of the cadastral surveyor.

7. DO-IT-YOURSELF CADASTRAL SURVEYING

The following scenarios concerning do-it-yourself cadastral surveying can be considered:

1. Do-it-yourself cadastral surveying will not be allowed. This is the situation in many jurisdictions today, where only licensed surveyors or government officials carry out cadastral surveys. The advantage of this option is that the tasks and responsibilities of parties are clearly identified. Given the (technical) developments all parties will increasingly have to justify their involvement. Using the available technology, stakeholders will become more critical and will be able to check the surveying results.

2. Professional parties are allowed to execute do-it-yourself cadastral surveying. In the land market a number of professionals is frequently involved in property transactions. These professionals would be able to determine cadastral boundaries, given the fact that only limited technical knowledge is required. Quality assurance of the cadastral surveying process remains important in order to warrant legal security. It seems reasonable that performing these activities requires a license. Disadvantage of the approach is that some professionals may have an interest in the real-estate transactions and are not independent. In such cases the cadastral surveyor is the right person.
3. Do-it-yourself cadastral surveying is fully implemented. The technical and legal infrastructure exists to guide stakeholders in the process from boundary identification to recording. The execution of the process has to follow a fixed protocol that warrants that the necessary legal and cadastral aspects are secured. In many cases parties will still rely on the supervision, guidance or execution of the process by experts like the cadastral surveyor. In difficult situations the experts will still have to execute the tasks. This option requires a high level of quality assurance and secured, standardized transaction protocols.

Which scenario is the most likely depends on developments in the land market, the legal system and the role of the cadastre in maintaining legal security. Technology exists to do many things yourself. In the end it is the balance between maintaining legal security for all stakeholders involved and efficiency in the land market that will determine which scenario will prevail.

8. CONCLUDING REMARKS

We have considered various aspects of cadastral surveying. The outlined developments have a large impact on all aspects of property transactions and registration of rights. All parties involved in the land market will face a similar discussion (e.g. notaries and real-estate agents).

Looking at cadastral surveying the do-it-yourself approach is technically possible. The neighbours acting in the introduction may really exist in future. GPS is one, and not even the most important, technical development. It provides everyone with the ability to locate boundaries. The surveying and mapping itself will become simpler and will require less expertise.

The actual introduction of do-it-yourself cadastral surveying depends heavily on legal, institutional, and cultural issues. The expectation is that for simple cases do-it-yourself cadastral surveying will emerge. First for licensed parties, among which the surveyors, but in the long run also for private property holders. The latter case is only practical if the parties are supported by procedures, which warrant the legal security and the rules are observed for the definition, identification and demarcation of boundaries.

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BIOGRAPHICAL NOTES

Martin Salzmann heads the geodesy section of the Netherlands' Kadaster. At the Kadaster he is responsible for the maintenance of the national reference system. Furthermore he is involved in consultancy on new techniques in surveying and mapping, working procedures, and quality assurance. He has been with the Kadaster since 1996. He holds degrees (MSc. and Ph.D. in Geodesy) of Delft University of Technology in the Netherlands.