

TOWARDS A COOPERATION BETWEEN THE REGISTRY HOLDERS OF THE LARGE SCALE TOPOGRAPHIC MAP AND THE CADASTRAL MAP

A narrative anchor for consistency between both maps

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A thesis submitted to the University of Twente (ITC Enschede), TU Delft, Utrecht University and Wageningen University in partial fulfilment of the requirements for the degree of Master of Science in the Department of Geographical Information, Management and Applications in the School of Spatial Science.

by

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born in Kampen

“When you place the new cadastral map over the new topographic map one would still be shocked by the differences between the two.”

- Harrie van der Werf, 2010 -

Source: Den Boer, A. (2010) *Verslag GIN-Symposium, 'Geoinformatie in Apeldoorn Buitengezet'*. Geo-Info 11: 16-17

Van der Werf made this statement at the end of a session about geo-referencing old manuscript maps. Despite the fact that it is said five years ago in another context it touches the theme of this research.

ABSTRACT

This thesis focuses on the cadastral map and the Key-register Large Scale Topography (BGT) of the Netherlands. The two maps are different because of its history, its purpose and its registry holders. Yet, the BGT is often used as a tool for referencing the cadastral boundaries with the surrounded topography. If the maps are used together there is change that dissimilarities occur where lines are expected to coincide. In the past there was a large scale fine tuning of both maps called project 'kaartverbetering'. But over time the amount of differences increases, due to unmatched workflows.

A poll addressed to the BGT registry holders indicates that they are willing to cooperate with Kadaster to create more consistency between both maps. They can offer local knowledge of cadastral map and the BGT, but they can also supply test areas of which they know the hard topography has a high geometric accuracy. If the same area in the cadastral map is of lower quality it can be used to for an update. The other poll send to the users of the cadastral map, indicated that dissimilarities between the two maps ensures annoyances. Furthermore, between the different user groups is a varied demand for geometric accuracy.

Eventually there is a clear need for more clarity around the cadastral map and this can be offered after a necessary internal check-up at Kadaster. If the (measuring) details and quality features of the map are clear, cooperation can be sought with the BGT registry holders for enduring cooperation for pursuing consistency between the both maps. Thereby attention should be paid for the image Kadaster has through its acts in history.

PREFACE

After 6 months of reading, interviewing, conducting polls, analysing, writing, rewriting it is now the time for the verb: 'sending'. Sending this thesis to the world in the hope it adds knowledge on the places where it is needed.

The research commissioned by the GIMA program and Kadaster gave me an insight in the small world of geo-information in the Netherlands. Everybody knows each other and after a period of time people even recognized me; partly due to the fact that I succeeded in sending out a poll to 15 thousand users of the cadastral map. This achievement was not appreciated by everyone, but it delivered the results I needed. For some people it will sound strange when I say that I mostly enjoyed doing this research. The subject captivated me from the first moment.

Regarding my working place I want to thank Meindert Sterenberg and Martijn Rijdsijk for making me part of the wonderful 'process & product innovation' department. I had a great time working there with the most kind colleagues and interns.

My apologies go out to all my family and friends. They supported me with love and empathy. What did I do in return? Giving less attention by not being there for them when they needed me.

I want to conclude by paying tribute to my supervisors. At Kadaster Eric Hagemans assisted me perfectly, especially during the first and last difficult weeks. Besides, he expressed his confidence in me what gave me the energy to continue the research with a smile. Furthermore I want to thank Edward Verbree for giving me the right advice and keeping me sharp. I really appreciated his honesty. I also want to thank Professor Peter van Oosterom for his helpful input and interesting anecdotes during the meetings.

Have a great time reading this pleasantly written thesis,

Alexander Boersema

14-08-2015

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ABBREVIATIONS

- **AHN** Actueel Hoogtebestand Nederland (Current Height file Netherlands)
- **AKR** Automatisering Kadastrale Registratie (Atomization Cadastral Registration)
- **BAG** Basisregistraties Adressen en Gebouwen (Key-register Addresses and Buildings)
- **BGT** Basisregistratie Grootchalige Topografie (Key-register Large Scale Topography)
- **BIM** Bouw Informatie Model (Construction Information Model)
- **BKOL** Basiskaart Online (Base Map Online)
- **BOR** Beheer Openbare Ruimte (Management Public Space)
- **BRK** Basisregistratie Kadaster (Key-register Kadaster)
- **BRO** Basisregistratie Ondergrond (Key-Register Subsoil)
- **BRT** Basisregistratie Topografie (Key-Register Topography)
- **DKK** Digitale Kadastrale Kaart (Digital Cadastral Map)
- **DBMS** Database Management Systeem (Database Management System)
- **(D)RA** ((Digitaal) Reconstructie Archief ((Digital) Reconstruction Archive)
- **GIS** Geographic Information System
- **GPS** Global Positioning System
- **I & M** Infrastructuur en Milieu (Infrastructure and the Environment)
- **IMGEO** Informatie Model Geografie (Information Model Geography)
- **LADM** Land Administration Domain Model
- **LKI** Landmeetkundig Kartografisch Informatiesysteem (Geodetic Cartographic Information System)
- **LSV** Landelijk Samenwerkingsverband (National partnership)
- **LV** Landelijke Voorziening (National Facility)
- **KPV** Kadastrale Perceelsvorming (Cadastral Parcel Formation)
- **HTW** Handleiding voor de Technische Werkzaamheden (Guide for Technical Proceedings)
- **NCGI** National Clearinghouse Geo Information
- **NETPOS** Netherlands Positioning Service
- **OGC** Open Geospatial Consortium
- **PDOK** Publieke Dienstverlening op de Kaart (Dutch National SDI)
- **PIB** Precisie, Idealisatie & Betrouwbaarheid (Precision, Idealisation & Reliability)
- **SDI** Spatial Data Infrastructure
- **SLC** Spatial Location Code
- **SVB** Samenwerkingsverband (Partnership)
- **TPG** Topografie Producerende Gemeente (Topography Producing Municipality)
- **WOZ** Waardering Onroerende Zaken (Valuation of Immovable Property)

1 | INTRODUCTION

1.1 | PROBLEM AND ITS BACKGROUND

This chapter will start with a description of the background of the research in which the BGT and the cadastral map will be treated. Subsequently, the problem is described which explains why this research is needed

1.1.1 | BACKGROUND TO THE RESEARCH

In the Netherlands there are separate institutions responsible for the collecting, processing and presentation of the cadastral map and the large scale topographic map. Kadaster is as registry holder responsible for the cadastral map. The provinces, Water Authorities, municipalities, ProRail, Rijkswaterstaat and the ministries of Defence and Economic Affairs are the registry holders of the Basisregistratie Grootchalige Topografie (Key-register Large Scale Topography, BGT). For a better understanding of these two maps the history and content of the BGT and cadastral map will be described. In chapter 2 a more detailed description of these maps is included.

Background of the large scale topographic map

With the BGT Act run into force on the first of January 2016, the transition of, among other data, the GBKN into the BGT must be realized. The GBKN is the current Grootchalige Basiskaart van Nederland (Large Scale Standard Map of the Netherlands) and it consists of line elements which represent topographic objects; this means that these elements do not contain further information about those specific area-objects and have no relation with other elements. It is the most detailed topographic map nationally available (Eekelen, 2001). The BGT will be based on area objects and physical objects like roads and buildings need to be included. These new standardization must generate a more efficient way for cooperation between the different registry holders. The aim is that the whole of the Netherlands will be surveyed only once, so no double measurements are made (LSV GBKN, 2012). This means through a redistribution of the responsibility of the different areas survey-overlap must be prevented. According to the Act BGT, a registry holder is an administrative or legal person to whom the responsibility was assigned to keep track of geographical data. The BGT consists of a country-wide topographic data infrastructure. Kadaster is only responsible for the distribution of the BGT through PDOK. The Dutch National SDI (PDOK) is a central facility for the dissemination of geo-datasets of national importance. This is actual and reliable information for both the public and private sectors. PDOK makes digital geo-data available as data services and files. Most PDOK services are based on open data and are therefore available to everyone. The PDOK services meet national and international standards, including the European INSPIRE and the Dutch e-government standards (PDOK, 2015). The aim of the BGT is to make key registered data available to all public institutions for a good performance of public duties and stimulating an efficient exchange and efficient use of geographic information. By ministerial regulation, a catalogue is established. The catalogue defines the information model for the geographical data which have to be included in the BGT according to this law. (Schultz van Haegen-Maas Geesteranus, 2013). This BGT data-catalogue 1.1.1 describes the guidelines which the registry holders have to follow. Among other things requirements around positional accuracy are described (§ 1.5). (van den Brink et al., 2013)

Background of the cadastral map

An extract of the cadastral map shows the cadastral parcels relative to the environment and is a product of Kadaster. It consists of parcel numbers, boundaries, main buildings, street names and house numbers. The map indicates legal certainty in relation to ownership, the indicated sizes can be used as basis for the calculation of land tax and visualises agreed property boundaries. (Kadaster, 2015a; van Oosterom et al, 2011). Many external users see the cadastral map as a juridical true visualization of the parcel boundary, but this not the case. The lines on the map are indicative. The exact location of the parcel boundary can only be derived from the (Digital) Reconstruction Archive (DRA), which consists of survey data with measurements of the boundaries (van der Hoek, 1999). Within project 'kaartverbetering' (map improvement) some LKI-parcel boundaries were equalized with certain margins with the topographic elements of the GBKN. This resulted in a (carto)graphic change of the cadastral map with mixed results (Hoekstra, 1997) (See also section 2.1.1 about the history of the cadastral map). The Landmeetkundig Kartografisch Informatiesysteem (Geodetic Cartographic Information System, LKI) is an application of Kadaster for the collection, processing and presentation of cadastral and topographic information (Kadaster Wiki, 2012). This system will be gradually replaced by Kadastrale Perceelsvorming (Cadastral Parcel Formation, KPV). The KPV should meet the 19152 ISO standard, were spatial representation (LKI) and surveys (DRA) must be integrated in one system (van Oosterom, 2009). Kadaster works out a plan for making a quality improvement of the cadastral map, called the '1-on-1 map'. The 1-on-1 map is the working title and is part of the vision of Kadaster. It is a digital map with a high geometric accuracy. The ambition is to combine the strengths of the survey data (accurate) with the cadastral map (complete). The goal is a better area size determination, easier surveying work, better communication with the user and better coordination with other registers (Hagemans & de Koning, 2015). Last goal mentioned will be a part of the research question.

1.1.2 | PROBLEM DESCRIPTION AND HYPOTHESES

In short the problem that occurs is the availability of two partly incompatible maps, possibly to no cooperation between the different registry holders of the BGT and Kadaster of the cadastral map. In this matter there has been cooperation and aligning in the past but that was temporary (Hoekstra, 1997). Koerten (2011) claims that a narrative anchor is an essential building block for holding together an information infrastructure. The narrative anchor has to be able to link time, technology and territory. He posited that such a narrative anchor was essential in the realisation of the GBKN. Although this statement needs to be nuanced, it can be helpful to have a shared story by the several parties that can be explained differently according to the specific stakeholder, but a lot of other factors also play a role. The missing of a narrative anchor was part of the failure of two other geographical information projects; the NCGI (National Clearinghouse Geo Information) and the Geoportals project. Both projects appeared to be initiatives for technological renewal, which are outdated as soon as innovative ideas are ready to be used in practice, which leads to cyclic process of continuous renewal. Techniques were subconscious seen as more important than the essence of the project so they did not get the projects finished. This research will be a search for the narrative anchor of the information structure between the cadastral map and the large scale topographic map. The cadastral and the topographic map have a various thematic and geometric quality, dependent on the map, but also on the region. The separation of responsibility is historically determined, but if the two maps are used together it can create confusion. There can be assumed that this will happen more and more in the near future now key-registers are becoming more accessible. Figure 1.1 shows an example that in the municipality of Leiden the BGT and the cadastral map are locally incompatible. The

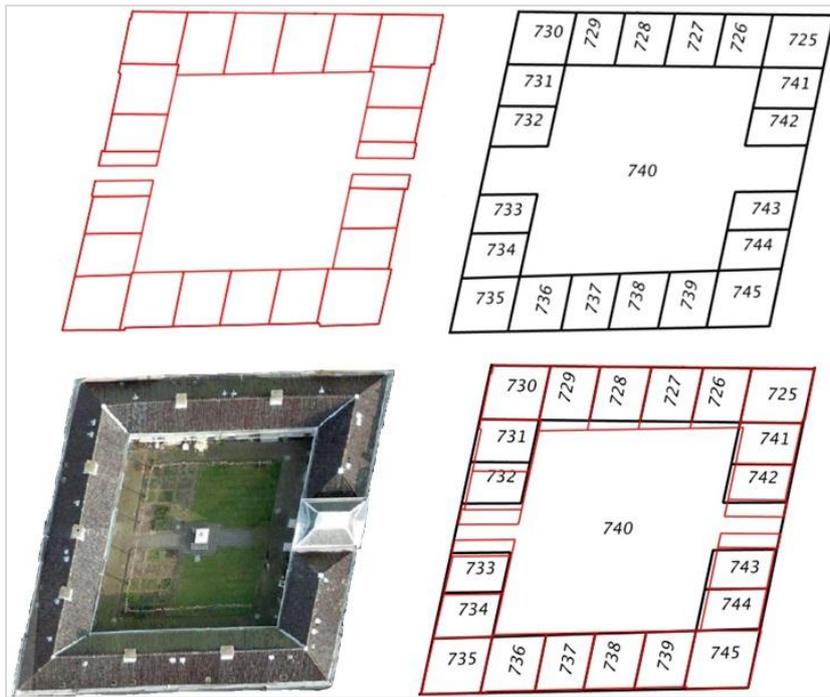


FIGURE 1.1: 'TEVELINGSHOFJE LEIDEN', BGT (A), CADASTRAL MAP (B) & GOOGLE MAPS (C)
 (SOURCES: PDOK AND GOOGLE MAPS, 02-07-2015)

red lines are the contours of the buildings according to the BGT; the black lines are the boundaries of cadastral map. The lines do not necessarily have to overlap, but in some cases there may be assumed that they should. For example the cadastral boundaries of terraced houses, like in the Tevelingshofje (almshouse), do often overlap with the centre of the wall between the two houses. Differences of 1 meter occur as with parcel number 729. According to the BGT that specific parcel has a surface of 34 square meters and according to the

cadastral map 28 square meters. With parcel number 742 it is the other way around with 4 square meters difference in favour of the cadastral map. The more confusing is that there is also the official published surface in the administrative system (LKI or KPV). The calculations behind it are not always traceable, because it can be the result of an endless redistribution of parcels (boundaries). Finally, in a few cases the surface is derived out of a boundary reconstruction (Hagemans, personal communication, 14-08-2015).

Some BGT registry holders have indicated that they will supply a higher positional accuracy than required (Ministry of I & M, 2014). Besides Kadaster recently started project 1-on-1 map for a quality improvement of the cadastral map. This can be an advantage for Kadaster, the different registry holders, but also for the user. With joint efforts for a better product and/or cooperation the following opportunities may occur:

- To realize a qualitative improvement of the cadastral map local measurements of survey data of Kadaster can be used which have a standard deviation of 5cm or better. These boundaries are relative to topographic elements. In this case the more accurate the used topographic map is, the more reliable the boundary points can be put in place. This can be advantageous for the development of project 1-on-1 map.
- Currently there are some feasibility studies for automatically deducing the Basisregistratie Topografie (Key-register Topography, BRT) of Kadaster out of the BGT. In this sense the quality of the BGT is related to the BRT, but this is more topographic based instead of geometric. It focuses on different scales and generalisation.
- The link can also be found with other registrations as the Basisregistraties Adressen en Gebouwen (Key-register Addresses and Buildings, BAG). Because the points saved in the DRA are mostly relative to buildings this registration seems to be of great importance for giving the cadastral map a qualitative improvement. Without going in to much detail the surface area of the buildings in the BAG (seen from above) are different than of the buildings in the BGT (seen

from ground surface). The measurements of the ground surface are essential for the DRA this is why the BAG is less useful. This topic will be further elaborated in section 2.3.

- With the aim of Kadaster to make a qualitative improvement in the cadastral map and the availability of high qualitative topographic map, the user will get clearer products. The maps will be better compatible, but it also improves the trust in Kadaster as distributor of the BGT and cadastral map.
- Cooperation between Kadaster and the BGT registry holders in favour of the cadastral map and the BGT is one of the purposes of the key register system of the Dutch Government.
- A geometric better qualitative product can lead to an increase in the number of uses. If this assumption is really the case that will be validated by conducting a user needs poll. There can be imagined that for finding a route from A to B a highly accurate map is less important than for an inspector of cables and pipelines who cannot dig 20 centimetres on the wrong site.
- Distrust between registry holders will disappear.
- It is a first step to a 3D cadastral and topographic map. When are objects inside, touching, equal or overlapping? This is complicated in 2D, but even more complicated in 3D (Stoter & van Oosterom, 2010).

Stakeholders

A part of the problem is the high amount of stakeholders that are involved. Every stakeholder has other interests, funds, knowledge and power. Obviously, not every stakeholder can be involved in the research. Therefore a balanced group must be formed in favour of a good inventory. A couple parties or individuals will be interviewed, and even a larger group will get a change to fill in a poll.

- Registry holders
 - Kadaster
 - BGT ((432) 01-01-2015)
 - 1] Municipalities (393)
 - 2] Provinces (12)
 - 3] Water Authorities (23)
 - 4] ProRail
 - 5] Rijkswaterstaat
 - 6] Ministry of Defence
 - 7] Ministry of Economic Affairs (Kadaster, 2015e)
 - Samenwerkingsverband voor Bronhouders (Partnership for registry holders, SVB-BGT)
- Users
 - Citizens
 - Public utility companies
 - Public services
 - Commercial companies
 - Construction
 - Real-estate
 - Planners
- Others
 - Geonovum
 - National Partnership GBKN

1.2 | RESEARCH OBJECTIVES

This section will discuss the research identification. First of all, the research goal and objectives are provided. The research questions will be derived from the research goal and the objectives. Furthermore, the innovation of this research and related work are described, as well as the research limitations.

1.2.1 | RESEARCH GOAL AND OBJECTIVES

The goal of this research is to investigate the need and subsequently the possibilities for cooperation between Kadaster and the BGT registry holders which will contribute to consistency between the cadastral map and the large scale topographic map of the Netherlands. In order to achieve this goal the following research question is defined:

What form of cooperation, at an organizational level, between Kadaster and the registry holders of the BGT can contribute to more consistency between the cadastral map and the BGT?

The aim is to focus on cooperation on the organisational part rather than on the technical part. The realisation of a constructive partnership is dependent on a couple of factors, as politics, money and dissimilarities in interests. These factors need to be mapped and eventually it must become clear what the possible benefits can be of cooperation, for Kadaster, the BGT registry holders, but also the user. In other words, the narrative anchor needs to be found (see section 1.1.2).

1.2.2 | RESEARCH QUESTIONS

For the structuring of the research and to find an answer on the main question the following sub questions are formulated:

1. Map improvement

- a. *To what extent was the result of 'project map improvement' of Kadaster an improvement of the cadastral map?*

This question will address the previous objective of Kadaster for improving the cadastral map as described in section 1.1.1. With this process in mind it is wise to look at the current state of the cadastral map, but also to the BGT. To what extent is there still room for improvement? Because the BGT is still in development the answering of the question will be indicative and cannot be nationwide aligned. It is inevitable to include the history and the current state of the GBKN in the answering of this question. Correspondingly this raises the question; to what extent can the cadastral map be of any help for improving the BGT? But also the other way around, the possible use of the BGT for improving the geometric quality of the cadastral map will be investigated. What is recommended, an onetime clean up or an adjustment in the workflows to keep the data sets aligned?

- b. *Which improvements can still be achieved for the cadastral map and the BGT and to what extent can both registrations help each other to realize this?*

The answers to these questions will give an insight in the dependencies between the cadastral map and the BGT.

2. Inventory motives BGT registry holders

Because the national cover of the BGT is a combination of regional parts supplied by different registry holders there can be assumed that there will be differences in the quality of the supplies. What are the motives for registry holders for maintaining a certain quality? It is important that these will be inventoried in combination with their opinions about closer cooperation with Kadaster.

What are the drivers and barriers for a BGT registry holder to pursuit a certain geometric quality?

The answer to this question can be used as input for further research to the technical inventory of the geometric quality of the different BGT regions.

3. Inventory User Needs

The BGT is open data, but for the cadastral data there are some restrictions for usage. The purpose for usage will be validated, fees will be charged and general delivery conditions are into force (Kadaster, 2015). But in theory everyone has access to the both maps and can compare them. The objective of question 3 is to find out the (dis)similarities between the preferred geometric qualities for the different user groups, for example the citizens and the real-estate agents.

Which user groups can be distinguished in terms of the desired accuracy of the cadastral map and is there a need for consistency with the underlying topography?

How disturbing are the current differences to the various groups of users? Is it really perceived as a problem? This will be investigated.

4. Narrative anchor

Finally, with the knowledge gained through the previous questions, it is possible to describe the narrative anchor, if it exists, which justifies cooperation between (most of) the concerned stakeholders.

To what extent is there a narrative anchor as a base for cooperation?

The answer to this question is a summary of all the needs of the users of cadastral map, Kadaster and the BGT registry holders and gives an indication on how to give form to the cooperation.

1.2.3 | JUSTIFICATION OF THE RESEARCH AND THEORETICAL FRAMEWORK

For the justification this section describes the extent to which this research is innovative. Thereby related work in the literature will be treated.

The realisation of the BGT and project 1-on-1 map are relatively new developments. As far as known, there are no researches carried out to the cooperation between Kadaster and the registry holders BGT



FIGURE 1.2: CADASTRAL BOUNDARIES AND BGT LINES IN THE MUNICIPALITY OF LEIDEN
(SOURCE: PDOK, 21-05-2015)

in this field. This gap will be filled with this research, keeping in mind the cooperation during the alignment of the cadastral map with the GBKN since the year 1998 (see section 2.1.1). As figure 1.1 and figure 1.2 demonstrate, there are clear differences between the two maps. In figure 1.2 three examples are circled. A. There is a gap of approximately 50 centimetres between the boundary (black line) and the wall of the building (red line). B. Parcel

boundaries running through three different sheds. C. The boundaries are straight while the building shows some curves. There is a need to figure out the origins of these differences and to come up with a possible narrative anchor as a base for cooperation.

Among others Koerten (2011) and van der Meer (2007) have described the history and creation of respectively the GBKN and project Map Improvement. Thereby the role of Kadaster and its relation with other public institutions is slightly touched. These reports will be used as foundation and inspiration for answering research question 1a, b and c. In particular the dissertation of Koerten (2011) is very interesting for this research, because he describes the Dutch geo-information field as an outsider. As sociologist he had the task to investigate the 'success-and-failure factors of the Geoloketten project'. In context of the Dutch National Spatial Data Infrastructure (NSDI) he did some recommendations for the development of geo-information-sharing in the future. In this light the cooperation between Kadaster and other parties is discussed. Another useful document regarding the cooperation between Kadaster and other parties is the article of Schut and Meeldijk (1999) who describe the process of one of the attempts for improving the geometric alignment of the cadastral map with the GBKN. A report which can be seen as a precursor of the 1-on-1 discussion is 'The new surveying' of Kenselaar (2011). He deposited that thinking about a cadastral map with a 2 to 5 centimetre precision is only useful if the underlying topography is on a scale around 1 to 1. For this research this opinion will be re-evaluated.

1.2.4 | DELIMITATIONS OF THE SCOPE AND KEY ASSUMPTIONS

This section describes the limitations of this research and some key assumptions.

At first, the focus lies in the organisational part for a possible improvement in the current cooperation form. The technical part will not be included in this research. As regards to the inventory of the motives for certain geometric quality, it is outside the scope of this research to give a nationwide view of the different qualities. The goal is to find out how this data can be inventoried and the data will be used for the recommendations on cooperation forms.

The creation of an inventory plan of the geometric quality of the BGT and the cadastral map will not be part of this research.

A logical extension of this research is to develop a communication plan for the users. With the knowledge of the quality of the BGT and the cadastral map and its relation a plan can be worked out how to communicate this information to the user. Out of the plan must become clear how the both maps must be presented to the user what should cause minimal confusion. This subject will be touched, but needs to be further elaborated after this research.

1.3 | APPROACH

1.3.1 | METHODOLOGY

This section will be structured according to the research questions listed in section 2. First the concerning question will be repeated and subsequently the method(s) and the expected result will be described. The underlying methodology is the narrative inquiry, also known as narrative analysis. It is a form of qualitative research that emerged in the field of management science and later also developed in the field of knowledge management (Cleveland, 1989). This form of analysis is also used in the dissertation of Koerten (2011), see also section 1.1.2. The purpose is to detect broad based

stories which justifies or disapproves a common pursuit for cooperation. It gives meaning to the current situation through the meaning that people assign to them (Klein & Myers 1999). So by polls, interviews and literature reviews opinions will be collected and validated. Subsequently it will be structured in a readable narrative.

1. Map improvement

- a. *To what extent was the result of 'project map improvement' of Kadaster a quality improvement of the cadastral map?*
- b. *Which improvements can still be achieved for the cadastral map and the BGT and to what extent can both registrations help each other to realize this?*

These two sub questions all get the same approach. For finding an answer a **literature review** will be done, besides **experts** in this field will be **interviewed** (section 3.3). The result is a description of the content of project map improvement and critical view on the results. Consequentially, possible improvements for the current cadastral map can be suggested and eventually there will be looked to what extent the BGT can of any use to achieve these possible improvements. Therewith, an analysis will be done on basis of the literature and interviews how the cadastral map can help improving the BGT.

2. Inventory motives BGT registry holders

What are the drivers and barriers for a BGT registry holder to pursuit a certain geometric quality?

To find an answer to this question the different registry holders will be polled. This **poll** will consist of questions about motives for a certain geometric quality, opinions about cooperation with Kadaster and who are there customers. This last theme is essential for answering research question 3. Besides overall bodies and field experts will be **interviewed** (section 3.3). There will be tried to provide a complete view as possible.

3. Inventory user needs

Which user groups can be distinguished in terms of the desired accuracy of the cadastral map and to what extent is there a need for consistency with the topography?

The inventory of the user needs is done in close cooperation with the marketing and communication department of Kadaster. Besides a couple of the included questions are prepared by the product and process management department and will not be used in this research. The **poll** was send to all the users of the cadastral map of last year, 15.592 in total. Excluding the bounce and out-of-office messages the poll was send to net amount of 14.555 potential participants. Finally the high amount of 1876 users responded to the poll. The resulting needs will be translated in to arguments for or against cooperation and can be used as input for the search for the narrative anchor.

4. Narrative anchor

To what extent is there a narrative anchor as a base for cooperation?

The formulation of a possible narrative anchor will primarily be the result of an **analysis** of the outcomes of the previous questions. The outcome can be send back to a couple of stakeholders. With their reaction the narrative anchor can be validated and used for answering the main question.

Out of the conducted interviews anonymous quotes are used which describes how experts and stakeholders think about certain themes. By sending it back to the interviewees these quotes and the accompanying context are (double) verified. They all agreed on the translation in English and the interpretations made on the basis of their comments, sometimes after some minor changes. None of the held interviews were the same, because they are all personalised to the respondent. For eventual inspection the transcripts and the audio files are saved apart from the thesis.

The conducted polls are to substantiate certain quotes, but also for finding new insights in a quantitative way. The answers out of the open questions are, if needed, classified. The resulting classes are used to give an indication how the BGT registry holders and users of the cadastral map think of geometric accuracy and consistency.

1.4 | OUTLINE OF THE THESIS

The thesis is ordered according to the sequence of the research questions. This section was an introduction. It treated the problem and its background, the research objectives including the main question, the approach that will be used in this research and it ends with some definitions essential for understanding the thesis. Chapter two will handle the history, present and future of respectively the cadastral and the large scale topographic map of the Netherlands. In the last section the relation between the two maps will be discussed. Subsequently in chapter 3 the motives of the BGT registry holders and the users of the cadastral map will be inventoried and discussed. Chapter 4 focuses on the story behind (un)common pursuit for cooperation. What do those involved in this matter tell to their stakeholders? The final chapter consists of conclusions and recommendations.

1.5 | DEFINITIONS

Although this research will not focus on the technical part, it is important to discuss basics about positional accuracy. These formulas are still the standards for the cadastral map and the BGT. Besides the terms precision, reliability and accuracy are often confused with one another. Also the Dutch coordinate system will be explained.

Positional accuracy

The **precision** describes the sensitivity of the results to random errors in the observables. Therefore, the impact of these deviations is described as a result of the measurement and processing. **Reliability** describes the sensitivity of the measurement and processing for model errors. Good precision does not always mean good reliability, but are together referred to as **accuracy**. (HTW, 1996). The standards of positional accuracy between two coordinates in the national reference system of the cadastral map are specified relative to the mapping scale; $\sqrt{2} \cdot 20$ cm in urban areas and $\sqrt{2} \cdot 40$ cm in rural areas, better known as **graphic precision** (Schut & Meeldijk, 1999). Regarding the BGT the required accuracy is object dependant with a distinction between objects with a high required positional accuracy ($\sqrt{2} \cdot 20$ cm) and objects with a low required positional accuracy ($\sqrt{2} \cdot 40$ cm) (van den Brink et al., 2013).

Coordinate system

A coordinate system is a system with the definition of coordinates, in which a relative location of points can be described using coordinates. In the Netherlands the reference system is called RD-stelsel (Rijksdriehoeksstelsel). With special GPS-receivers (Global Positioning System) satellite signals are received and saved in a very accurate way for calculating the coordinates for the measurement of the cadastral boundaries (Kadaster, 2011).

2 | MAP IMPROVEMENT

2.1 | CADASTRAL MAP

The way people think about the cadastral map has changed over the years. Some ideas found passage; others were cancelled or where put on hold. This section describes the past, present and future thoughts behind the cadastral map.

2.1.1 | HISTORY CADASTRAL MAP

The roots of Kadaster are planted by Napoleon in 1811, since that moment the cadastral measurements are deservingly. It was essential for collecting land taxes of landowners. The quality decreases in 1826 because there was more urgency. The goal was to make Kadaster operational in 1832 (Kadaster, 2015d). Since 1878 Kadaster found it unnecessary to throw away the measurements made for the cadastral registration. From that moment the survey data needed to be saved for making maps that help reconstruct the complete history of a parcel. In the early twenties the regime became even stricter where every measurement and correction a surveyor did need to be documented and put in the reconstruction archive. (van der Meer, 2011; Velsink, 2015).

“In the eighties and nineties of the last century well educated surveyors became too expensive. This trend was a risk for the quality of the measurements, because the employee became less critical and less able to estimate the value of certain decisions”

There must be said that, the technical progress in the work field demands less craftsmanship of the surveyor. Van der Meer (2011) describes that since 1976 the methods of measurement are drastically changed. In that year Systeem Detailmeten (Detail measurement system) was introduced. This was the foundation for a coordinate cadastre. This means a cadastre which uses exact coordinates instead of relative points for the location of boundaries and parcels. The used instruments went from measurement lines, to tachymeter's, to GPS. Since 1984 the cadastral maps where digitized. This also brought the introduction of the Landmeetkundig-Kartografisch Informatiesysteem (Geodetic Cartographic Information System, LKI). The maps which were already drawn in RD-coordinates where included in the LKI. Soon replaced by an information system already mentioned, Kadastrale Perceelsvorming (KPV). The bijbladen (side maps) without RD-coordinates needed to be calculated into the coordinate system with the help of so called inpassingspunten (fit-in points). Before, Kadaster made use of the GBKN because it was drawn in the same scale. Surveyors saw it as a necessity but regret the determination of the geometric quality in some parts due to the aligning with the GBKN. Eventually it brought map renewal, without the GBKN it would cost a fortune and would not be finished before 2050 (Koerten, 2011). Because the GBKN was not yet nationally covered and the big demand for a digital cadastral map the remaining analogue maps where digitalized accelerated without using the GBKN. This project started in 1994 (van der Meer, 2011). A concerned Kadaster employee:

“Then we have accelerated the digitizing progress, keeping in mind, only when the customer demands it the map will be improved. ”

This phrase is an indication of the priorities at the time; there were no signals that the map needed a high geometric quality. With the accomplishment of the LKI a nationwide Digitale Kadastrale Kaart (Digitalized Cadastral Map, DKK) was created in 1997. Retrieving records by specific cadastral

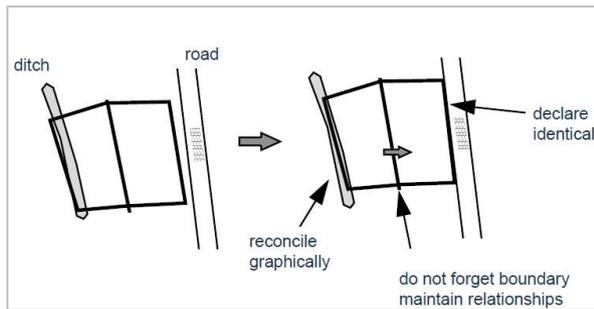


FIGURE 2.1: ALIGNMENT CADASTRAL BOUNDARIES WITH TOPOGRAPHY GBKN (SALZMANN, 2015)

municipalities was no longer necessary (van der Meer, 2011). Coupled to the analogue to digital conversion, Kadaster applied a map improvement by comparing the LKI-parcel boundaries to the topography of the GBKN. If these fit within a certain margin the boundary line should be levelled up with the topographic line element (Hoekstra, 1997); the middle of a ditch for example and not only buildings. Only if it seemed right according to the surveyor, so Kadaster puts

trust in the craftsmanship of that person. An example is visualized in figure 2.1. The right boundary of the right parcel is declared identical with the left side of the road by the surveyor. Through the existing relationships with the other parcel boundaries the left boundary of the left parcel graphically reconcile with the middle of the ditch in the new situation. According to an internal audit on this project only improvements were made on basis of an expected or proven good GBKN (Adelaar & Eekelen, 1999). If this was really the case that can be questioned; a Kadaster employee who was involved in this project:

" [...] and I also made the first impetus to the improvement process of the digital map, other people labelled it as the map deterioration process."

This quote is characteristic for the results of the project. The map improvement had mixed results with even some deterioration; locally geometric accurate cadastral boundaries are made undone by aligning them with less accurate topography in the GBKN. This less accurate topography was due to the analogue creation as well as the digitization of the GBKN, entailing inherent inaccuracies. The allowed margins for the alignment of cadastral parcel boundaries where set on circa 28 centimetres in built up areas and circa 56 centimetres in rural areas (van der Meer, 2011). In the poll (see also § 3.2.2) send to the BGT registry holders one of the respondents explains why he finds the cadastral map not a good product: 'For us a good cadastral map was aligned with GBKN of poor quality during the project map improvements in 2003. Only the parcel number was on the right spot. I can give you an example of a shift of the cadastral boundary of two meters.' Although it was deterioration for the geometric accuracy, it was an improvement for the overall image of the map. It still met its goal as an index for the DRA (see § 2.1.2). Another employee of Kadaster involved in this project:

"At that time it was a logic decision, with the knowledge of today we would use a different approach."

The above quote can be seen as an extra motivation for this research. Without looking back it is not possible to learn from the experiences of the past. The upcoming project of Kadaster can become too extensive. Taking wrong decisions which can be avoided is unacceptable. In section 1.5 the current standards of 20 and 40 centimetres are already mentioned. These numbers do not arise from the choice of policy makers, but find its origin in the line thickness of the pencil of the cartographer. In the period of analogue maps this was the maximum achievable accuracy and after digitalizing this accuracy did not improve. The ability to create maps with an accuracy of a few centimetres is relatively new development (F. Kenselaar, personal communication, May 31, 2015). The next section will treat the question either these standards need to be sharpened or not. Before taking a look in the future, the current state of the cadastral map will be analysed.

2.1.2 | CURRENT CADASTRAL MAP

The current cadastral map still has a variety of quality. There are areas with terrestrial precision (is specified to terrestrial measurements and is smaller than circa 7 cm ($\sqrt{2} \cdot 6$) (GBKN-Zuid, 2006)); other regions only meet the current requirements of graphic precision. Research centre Alterra carried out the last external audit Basisregistratie Kadaster (Key-register Kadaster, BRK) (Storm et al., 2012). Unfortunately, the cadastral boundaries are not included in this research. The used method based on data out of 2008 proved to be inadequate. The same audit shows that the cadastral surface was in 2011 for 99% and for the first quarter of 2012 for 98% correct. That is within the allowed margin where at least 95% of the measurements of new boundaries and the calculation of new surfaces must comply with the technical specifications (standard deviations) described in the Handleiding voor de Technische Werkzaamheden van het Kadaster (Guide for the technical processes of Kadaster, HTW) 1996. The next external audit will be finished after the deadline of this research. A part of the master thesis of Bennekom-Minnema (2008) is about the quality of the cadastral map of the Netherlands. In his research he states that in general the required graphical precision is obtained, maximum 20 and 40 cm differences in respectively urban and rural areas. However, individual cases exist where these boundaries are exceeded. Despite this research is dated the quality coordinators of Kadaster say that can be assumed that the quality is still the same. Besides, they posit that it is not really useful to look at the quality of the cadastral map. Because it current use as an index the quality meets the requirements but is really diverse and misses quality indicators here and there.

Quality features

There are two kinds of quality indicators, the first better known as PIB (Precisie, Idealisatie & Brouwbaarheid; Precision, Idealisation & Reliability). The inventory of the PIB-data is obliged according to the guidelines in the HTW but is not integrated in the LKI. Better known are the 'quality features', but those are not longer part of the workflow because the reliability could not be guaranteed. This code system makes the quality of the cadastral map visible for external parties. For example, code T2 is terrestrial measured with precision rank 2 (2 to 5 centimetre), D4 digitized measured with precision rank 4 (circa 20 centimetre). These details are available in an underlying database, but are not longer made visible in the cadastral map because errors are observed in the current data, whereby the essence of the 'quality features' is ignored. Currently there is internal discussion about making these details available again (Hagemans, personal communication, 06-07-2015).

Factual surprising

With the current abilities of the measurement instruments can be expected that the quality of the cadastral improves with each new measurement. But these accurate measurements will also be implemented in the less accurate cadastral map (Bennekom-Minnema, 2008). If this process is reversed the cadastral map will slowly increase in quality. So the cadastral map will be adjusted on the survey measurements. The current discussion is about whether narrowing down the allowed quality margins, towards a nationwide 1-on-1 map. There can be questioned if there is a demand for such a map with a 2 to 5 centimetre precision. A couple of reactions of interviewees in and outside Kadaster underline this feeling:

"A 1-on-1 map is not necessary, there is no demand from the user."

"It was never intended otherwise than as an entrance to the administrative registration at Kadaster. "

These reactions arise from pragmatic reaction on the situation, why change a functioning system. But at the same time it is the place where the sticking-point actually lies. Van der Meer (2011) calls it the 'paradox of the cadastral map', the only available data of boundaries are in the cadastral map, which cannot be used for the deriving the (absolute) location. With this in mind the slogan of Kadaster is on the one side striking and on the other side confrontational; 'Feitelijk Verrassend' (Factual Surprising). As outsider you expect the cadastral map to be factual, but surprisingly there is the fine print, which tells the user that no rights may be derived from the product. This dilemma is still an intern discussion and it necessitates Kadaster to develop a vision on this matter for the future.

2.1.3 | FUTURE CADASTRAL MAP

It is difficult for Kadaster to develop a story which satisfies the user and does justice to the cadastral map. The Kadasterwet (Cadastre act) prescribe that Kadaster shall establish rules regarding the form of the underlying documents of the cadastral map. The survey data (reconstruction archive) of what is shown on the map must be included in those rules (Nijpels, 1989). The act is non-committal and gives no decisive answer. It is the basis on which the separation of the cadastral map (entrance, index, graphic) and the reconstruction archive (insight, reconstruction and terrestrial) is built.

With the current 1-on-1 project, Kadaster is looking how the map and archive can be more intertwined. According to Zevenbergen et al. (2009) a Kadaster usually consist of two parts; a geographic part and a descriptive part. The relation of the two is of the utmost importance. They suggest that Kadaster can be kept much more up to date when the information on land transactions through land registration is made readily available.

At the same it is an attempt to move to a more positive system. Strictly, in a positive system the state guarantees property rights. This is strictly a juridical term where the basis of Kadaster comes up, as it collects, registers and distributes administrative and spatial data of property and the rights involved (Kadaster, 2015c). The typical difference between a positive and a negative system is that third parties may or may not obtain absolute certainties upon the information disseminated by Kadaster. The current system is also described as semi or quasi-positive (Holtman, 1992). It implies that the registered data may differ from reality, but through the additions in the law the user can put confidence in it.

Timmer (2011) posit that the debate about the question whether Kadaster must continue in a positive system is almost as old as the introduction of the negative system in 1946. It will be subject of discussion till there is a solution. But it is important to distinguish the legal (juridical) and the cadastral boundary in this matter. The legal boundary is the boundary of a plot which is the property right of a substantive law on real estate. The cadastral boundary is a boundary which is set by Kadaster in mathematical and cartographic data. The aim of Kadaster is that both boundaries correspond but that is not always the case (Louwman & Beckers, 1985). The director of strategy and policy of Kadaster:

“The 1-on-1 discussion is that users can trust on registrations and that it’s good enough. In legal terms this does not mean that it is positive or not; only in the perception of the society that you can blindly rely on cadastral registration.”

If a user puts out a request at Kadaster for a cadastral map the shown boundaries do not determine the question where the legal ownership begins and end. This boundary should be determined on the basis of the documents that are registered in the public records, such as a deed of delivery and

especially survey plans (Heesakkers, 2013). As said, ideally the cadastral and the legal boundary correspond, this avoids questions. What possibly helps and what the majority of the interviewees mention is that the reconstruction archive must have a more direct link with the cadastral map:

“ The data model needs a better design, what do you really want to register and how is that connected to the map?”

“ The user only needs to know of one point on the map which parcel number it is and what the survey data (measurements, date, instruments, surveyor) is of the boundaries. The demand of the customer is for 100% satisfied.”

“I had the idea, but I’m not the first, you need to speed up the connection with the digital reconstruction archive (DRA). With a right-click on the boundary you get the DRA profile.”

This direct link with the DRA is also described in the LADM. The LADM (Land Administration Domain Model) is described in ISO standard 19152:2012. It is an international standard for the domain of land administration, is intended to assist the alignment of land administration design with societal demands embedded in national and state land policies (Lemmen et al, 2015). One of the main goals is to provide an extensible basis for the development and refinement of efficient and effective land administration systems (Lemmen & Van Oosterom, 2014). A solution can be found in this model.

The ideas are touching the findings of Heath & Bizer (2011) that at this time web becomes ever more enmeshed with our daily lives. As a result there is a growing desire for direct access to raw data. It is also a call for linked data. Research should determine what achievable options are. What also came forward through the interviews is that there is no consistent vision on the cadastral map. Employees of Kadaster give different explanations to others. Kenselaar (2011) suggested that Kadaster would benefit from a clear statement. It is also important to take a look to what extent the large scale topographic map of the Netherlands can be of help for a possible qualitative update of the cadastral map.

2.2 | LARGE SCALE TOPOGRAPHIC MAP

This section will handle the development of the GBKN which eventually is part of a merge into the BGT. The focus lies in the position that Kadaster fulfilled in the creation of these nationwide large scale topographic map.

2.2.1 | GBKN

‘A map that took 25 years to complete’ is the title of an article of Van Eekelen (2001) written for GIM International to describe the organization behind the map. He describes that in the sixties and seventies a wide range of organizations and companies agreed on scale, structure, precision, visualization, contents, datum, material and the value of a standard base-map. The full responsibility was under the minister for Housing and Planning. Through provincial working groups Kadaster was assigned to the practical execution. In 1975 an energetic start was made. Because the realization of the GBKN was demand driven and only possible when there was sufficient funding, the map became fragmentary available. The allocation key in the production of the GBKN changed every couple of years. It was calculated looking at the use of the GBKN map by the different public and private organizations in support of their core business processes. (Peersman et al, 2005). The share in the

GBKN divided between the different participants between 1975 till 2008 is given in figure 2.2. As you can see at the start the share of Kadaster was 50 percent. Because of financial reasons and other motives it decreased to 20 percent in the last years of the GBKN. In the latest years of the map the provinces and water agencies get a bigger role. This is pushed through with the organizational structure of the BGT, what can be seen later on.

Party	1975-1985	1985-1992	1992-2002	2003-2008
Kadaster	50%	No data	20%	20%
Municipality	25%	No data	20%	30%
Utility companies	25%	No data	60%	45%
Provinces and water agencies	0%	No data	0%	5%

FIGURE 2.2: TABLE, FINANCIAL ALLOCATION KEY INVOLVEMENT GBKN OVER THE YEARS (SOURCE: PEERSMAN ET AL. 2005)

Koerten (2011) blames the disarray of Kadaster through it was preoccupied with its own resurveying problems, it was not interested in the future. Old problems were solved with proven technology. An employee of Kadaster describes how the municipalities looked at Kadaster at that time:

“Concerning the GBKN topography Kadaster punched above its weight in the past. ‘We are the partaker, direction, we decide which steps to take’.”

Kadaster became too noisy and that is the reason why there was often a broad-based feeling that Kadaster should cover the expenses (Polman, 2000). Others also question the role of Kadaster in the GBKN:

“You may wonder whether the GBKN should have been the primary task of Kadaster at that time. But it was attracted because the cadastral map had limited topography and that needed improvement. Probably the municipalities had done a better job.”

The development of a Public-Private Partnership in 1992 can be seen as essential for finalizing the GBKN. Its aim was to establish a national uniform coverage of the map and continue the production of the GBKN by regional alliances. A formal member of LSV GBKN describes uniformity of the map as follows:

“In general the map is everywhere the same, [...] but focusing on details you will notice that there is no uniform GBKN. There was no fine-tuning on the boundaries of the regions of the different organizations and municipalities. This was deliberately the case, otherwise we would never have found a solution.”

This was only the case in context with the Basiskaart On Line (Base Map Online, BKOL); the dissemination of the GBKN for the whole of the Netherlands. If the different parties are confronted with these mismatches they realize something needs to happen. Like a cable company notice that a cable between the municipalities The Hague and Rotterdam does not have a proper connection, and it affects the production process, they will speed up the specific fine-tuning process. It’s a policy what is based on demand driven production, it results in a time consuming progress for uniformity. Although this underlines the great importance of regional cooperation in the production and maintenance process, it also created awareness of the reality that decentralized and uncoordinated production of this map would lead to inefficiency, multiple data acquisition and processing. This could be even worse

with the BGT, see §2.2.2. Besides Peersmann (et al., 2005) concludes that the discussion of the cost allocation between the various users can be intensive and turns up at every change of regime. The spirit of cooperation and mutual trust has always ensured that they came to a consensus. Koerten (2011) describes it as the ‘narrative anchor’ that brings continuity; the term ‘base map’ is the driving force (narrative anchor) of the GBKN and not, as in other geo-projects, technology. The narrative anchor enables diverging technologies to be linked to the constant concept of base maps, ensures stability through time and stimulates standardization processes.

The article of van der Meer (1999) tells a futuristic story which describes the temporality of the GBKN. Although this article has a fictitious character, it shows how people thought about the map at that time. Through the fast development of the technology alternatives as photogrammetric images become available. With a high update frequency and automatic recognition techniques the GBKN becomes superfluous. Besides, the concerned parties did not longer want to commit to the topography map, one by one. After 40 years on the 9th of July 2015 the GBKN will come to an end. At that time he could not know that his prospect becomes reality with only a difference of one year. Despite he uses other causes, the development of its successor, the BGT, is already in an advanced stage.

2.2.2 | BGT

As been said in previous section the GBKN never has been homogeneous. This standardization will also be the main challenge of the BGT. It has been found that a common pursuit is not a guarantee to success. With the experienced gain out of the development of the GBKN there are organisational decisions made setting up the BGT. One important adjustment what improved the controllability of the BGT program is releasing the GBKN way of decision-making. This had let to an impasse in the renewal of large-scale topography in the Netherlands the last few years, because parties held each other in a headlock. That is the reason why the leading role in this renewal was given to a new program steering committee headed by I & M (Anneveld & van Rossem, 2013). The director secretary of LSV-GBKN describes in an interview (Boer, 2009) the organisational set up of the BGT. The predecessor ministry of has expressly opted for a participative management style program. It is a style where one seeks political support and active involvement of the whole field to gain a successful implementation of the BGT. So there is a search for support in and oversight the government. But also guaranteeing continuity, quality, cost efficiency and a sustainable production process are important. Whether this will work has to be encountered for there are more parties involved than during the GBKN. The intimately involved utility companies in the GBKN renounce financing and maintaining the BGT. Also they distanced themselves from the GBKN ownership rights. In return they want guarantees.

Some people say that the absence of Kadaster in creating the BGT is more or less due to the role Kadaster played in the GBKN. An insider of the SVB-BGT:

“In the eyes of several large- and the topography-producing municipalities the role of Kadaster was too big. They played an important role in holding Kadaster off concerning the BGT. Kadaster as data disseminator was obvious, luckily ministry of I & M thought the same.”

What is meant with a 'too big role' is that Kadaster had responsibilities were it not was lived up to. They asked too much money for their services and had other purposes with the GBKN than the other users or registry holders. This was partly due to financial reasons and due to other purposes of the map. But at that time there were no other organisations with the appropriate facilities (Koerten, 2011).

Apparently the allocation of the National Facility was also not a fixed cases, it was due to the trust given by the Ministerie van Infrastructuur en Milieu (Ministry of Infrastructure and the Environment, I & M). Some employees of Kadaster find it remarkable that Kadaster does not have an explicit role in the realisation of the BGT:

“The nice thing is, or you could say the sour thing is, we started in '75 with the utility companies the GBKN and who is not part of the BGT?”

It is a recurrent conflict that can be seen as centralisation (Kadaster) and decentralisation (different registry holders). Somewhat exaggerated can be said; centralisation means for the most part: standardisation, efficient working and one party responsible. While decentralisation usually means: regional knowledge, shared responsibility and a non-standardized way of working. For the realization of the BGT is chosen for regional expertise. The registry holders are responsible for a product which probably will be used mostly for intern processes. This makes it difficult to fine tune to one homogenous map.

It is logical from the nature of the business of the municipalities that they are one of the registry holders of the BGT. Kadaster primarily uses the topography as orientation for their cadastral map; the same applies for the utility companies. In the past SVB-BGT have sought rapprochement to Kadaster:

“I said to the responsible Kadaster employees, you could try to become registry holder of the nature areas. No one has good data of those areas and nobody is really interested in more accurate data than available. It is included in the BRT (Key-Register Topography) and as registry holder you are part of the decision and policy makers.”

Kadaster showed some interest but eventually this plan was never applied. Currently there is still discussion about this theme. The lack of responsibility for those areas ensures gaps in the nationwide coverage of the BGT. But if Kadaster chooses to become responsible for those areas as registry holder BGT, it needs to figure out with what intention and goal. Does Kadaster want a voice in the BGT or are there other underlying objectives? For example saving jobs:

“Maybe it is a possibility for creating jobs for (former) GBKN project leaders.”

With the expiring of the GBKN there are a couple of Kadaster employees soon without a job. Attracting a new task can repair this gap. Because the BGT is behind on schedule there is room thinking things trough; in chapter 1 the start date of the BGT is already mentioned. But an insider of the partnership-BGT (SVB-BGT) admits that it is no longer a realistic goal:

“ [...] on the first of October 2015 we do not have all the data and on the first of January 2016 not all the data is implemented in the Landelijke Voorziening (National Facility, LV).”

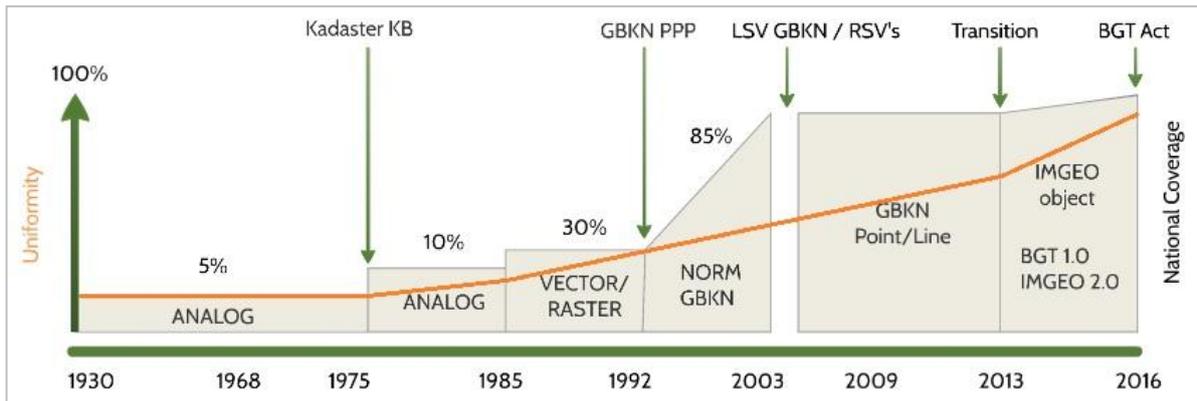


FIGURE 2.3: TRANSITION PROCESS OF THE LARGE SCALE TOPOGRAPHY (ADAPTED VERSION; SOURCE ORIGINAL: PEERSMAN, 2013)

As can be seen in Figure 2.3, the large scale topographic map of the Netherlands never reached a nationwide coverage, with a maximum of approximately 85 percent. Also full uniformity (orange line) was never reached and is also not achievable by the first of January 2016 through the BGT. This process will take several of years:

“The GBKN was a patchwork they said, because in every region there were certain specifications. This is true, but those differed not as much as the freedom one has in delivering optional elements above the obligated BGT. [...] Uniformity will be reached when I’m not longer working here.”

Apart from the mandatory BGT part IMGeo (Information Model Geography) includes standards that detailed characteristics of an object are standardized exchanged. These details are more important in the management of public spaces (Geonovum, 2015). Because this option, to add so called ‘plus topography’ to the BGT, the nationwide map gets more diverse. According to the chairman of the meeting BGT registry holders this will not be that bad:

“We get one uniform product. The degree of detail can differ, but the codes will be all the same.”

He is not yet familiar with the ongoing research of de Vries (2015), of Kadaster. He shows that the overall product looks homogenous. Zooming to the details displays interpretation differences. What is covered by the term driveway and what is part of a cycle way and what not? The opinions are divided; the one expects that this are only teething problems, the other thinks will take years to overcome this problem. What can be said about the geometric quality is that there will be a big difference between on the one side buildings in the rural areas (graphical precision) and the façades of buildings in urban areas (terrestrial precision). An employee of a big municipality about this matter:

“In Rotterdam almost all the facades of the buildings are measured with terrestrial precision. [...] This will be the case at most of the large cities. [...] The backside of buildings will not reach the precision of 2 to 5cm. Those are often mapped with graphical precision.”

Keeping in mind the predictions of van der Meer (1999) of last section the development of the BGT is a huge risk. The technology has not stood still since he wrote the article. Computers are faster, have more capacity, more storage space and the exchange of information is much easier. A formal Kadaster employee expresses his doubts:

“Isn’t it better to invest in aerial and satellite photography and height models as basis for the topography? [...] It is the question if such a map (BGT) is still interesting. Certainly not for the public, they rather use Google Maps ”

This statement raises the question what the reputation is of the website PDOK outside the field of geo-information. Besides, what are the developments regarding 3D, sensors, laser scan, AHN2, AHN3 (Actueel Hoogtebestand Nederland, Current Height file Netherlands, ortho photos and unmanned (ground/air) vehicles. Other interesting developments in this matter are big data and linked data. Keeping this in mind it is good to look for a link between the described maps above.

The next section will elaborate this relation between the cadastral map and the large scale topographic map.

2.3 | RELATION BETWEEN THE DIFFERENT KEY-REGISTERS

Cadastral map & BGT

In 2001 a real estate coordinator of the municipality of Hoogezand-Sappemeer indicated that there were discrepancies between the local cadastral and the topographic map, which bothered the intern processes (Kuijjer, 2002). Hoekstra (1997) already foresees that through the increasing availability of digital geographical maps the need increases for fine tuning the content of the different maps. With the advent of the BGT and the intention to give the cadastral map a qualitative update, this problem is still relevant. It is a recurrent theme; the combination of the cadastral map with other digital geometric information is becoming easier, so it is obvious that the notion of the limited geometric value of the cadastral map will be lost (van der Meer, 2011). But is it (still) really a problem or just a commotion that the concerned parties need to sit out?

For answering this question it is important to figure out the relation between the current cadastral map and BGT. The geographic link is inevitable; the cadastral map is nationwide and the BGT will also cover the whole of the Netherlands. According to a Kadaster employee seconded by Geonovum, the initiative lays by Kadaster:

“ [...] especially because the registry holders (BGT) have the topography in good order. You have to look at Kadaster, what does it have as ownership boundary, does it correspond with topography or is it an abstract concept? The trust in the BGT is mostly valid; you may have more confidence in it than in the GBKN.”

With the promising title ‘Magnification legal reliability Kadaster’ Louwman & Janssen (2010) gave a part of the vision of Kadaster for increasing the legal reliability. In this report of five years ago, the question is asked: ‘Should the cadastral map become more important with respect to the good faith?’. The recommendation states that the cadastral map should not play a bigger role in this aspect. In the future this could be possible for the reconstruction archive, but it should be disseminated in such a way that the information is understandable for others and a reference is made with recognizable solid topography. Like a record of the distance to a line parallel or as an extension of a wall. Currently the ambitions of Kadaster are a little bit changed as the current feasibility study shows: “from good to better” increasing geometric quality and consistency. In other words, towards a 1-on-1 map by combining the survey data with the cadastral map (Salzmann, 2015). See also section 2.1.3.

Zevenbergen et al. (2009) states that parcels and boundaries are abstract concepts. They are called 'institutional facts' which exist only by human agreement and are observer relative. Therefore one of the interviewees advises:

"The urge that one have to test everything in the map on hard topography, there you have to occasionally add some question marks. The difficult thing about the cadastral map is that it consists of cadastral boundaries, they are virtually."

Above argument shows a part of the general trend that can be picked out the interviews. Cooperation is not really necessary; both parties have strongly divided tasks resulting in two different maps. Other opinions of some interviewees:

"Create a database including topography, cadastral data and the reconstruction archive [...] with software which calculates all the datasets into one visualization. [...] Avoid discussion by aligning both maps exact together"

"We can assume that the registry holders have their topography in order. You have to look at Kadaster, what do they have as property boundary, does it coincide with topography?"

"We have the PDOK, how far reaches our cadastral responsibility that those maps coincide?"

In a report for Kadaster Kenseelaar (2011) asks if it is useful to think about a cadastral map of a 2 to 5 centimetre precision if the often used BGT as base map is of graphic precision. In an interview (2015) he even questions the value of the BGT for reference purposes. There are indications that the technique catch up and satellite imagery and ortho photos with a 2 to 5 centimetre precision become available against reasonable costs. Besides these new techniques can be used for creating reference data to estimate which of the two maps approaches reality the most; a referee for deciding whether the cadastral boundary or the aligning topographic line is right. It is even possible that both maps fall short. As extra tools possibly the HoloLens and the Oculus Rift can be used in the future for the surveying work. Another idea is making use of Volunteered Geographic Information (VGI); the user gives input about the exactness of cadastral boundaries and/or topographical objects (Salzmann, 2015). The feasibility of these techniques and ideas need to be further explored.

BRK & BGT

The BRK consists of the cadastral map and the cadastral registration of real estate and business legislations and it is operational since the first of January 2008. So it is more than only the map. Figure 2.4 (next page) shows the scheme of key-registers of the Netherlands. The registers are a part of the Dutch e government program. The producer of a register is obliged to guarantee the quality of the data and all the public agencies are obliged to use this information for their task (Kok, 2012) By leaving out the connections between (for this research) irrelevant key-registers the scheme is simplified. There can be seen that a connection will be made between the BRK (Basisregistratie Kadaster, Key-register Kadaster) and the BGT. According to schedule this will be conducted starting from the first of January 2017 (Stip, 2015). Another development for Kadaster is the link between the BRT and the BGT. This means, among other things, the (partly) automatic generalisation of the large scale to the regular scale topography map. The orange connections and key-registers are not yet realized. Notice that the connection from BGT to BRK is unilateral. Part of this research is to investigate if there is need and if

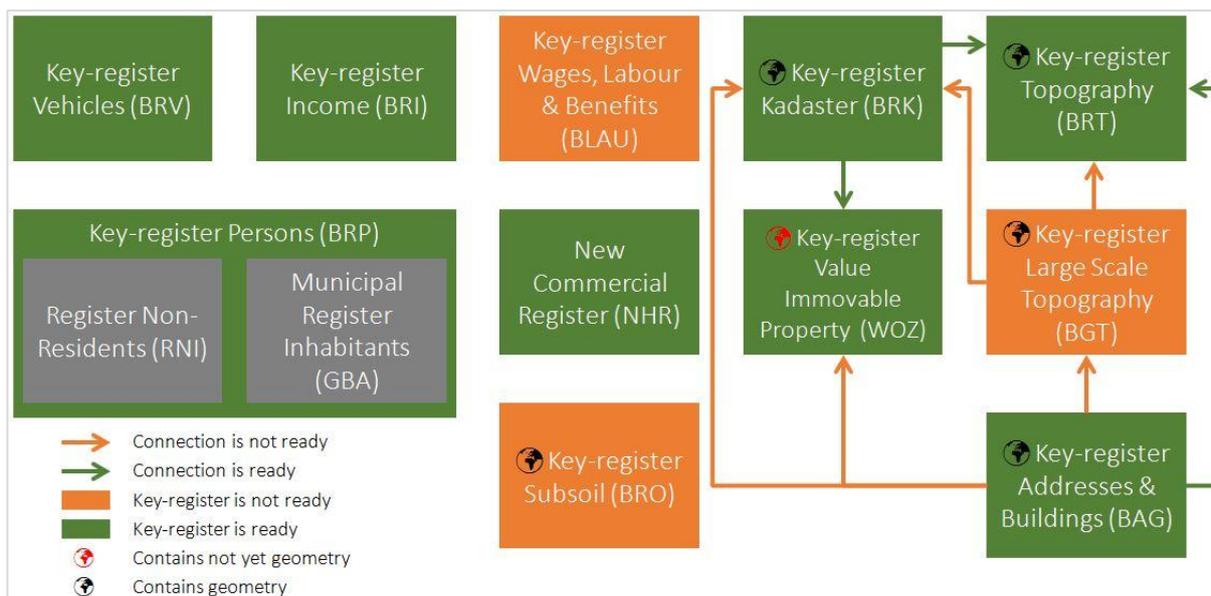


FIGURE 2.4: SCHEME OF KEY-REGISTERS, RELATIONS AND STATUS (ADAPTED VERSION; SOURCE ORIGINAL: STIP, 2014)

there are forms for a two-sided connection. There are two ways of linking the registers with each other, administrative and geo referenced linking. Administrative applies for all the registers, geo references only when the key-register includes an earth symbol.

BRK, BAG & WOZ

As mentioned in section 1.1.2 there is also a link with the BAG. This link is not (yet) realized in the scheme of key-registers (figure 2.4) and will be geometric and administrative. Respectively, the addressable objects must fit within the geometry of the cadastral parcel and the addresses of the addressable objects are equal to the location specifics of the cadastral parcel (Kadaster, 2014). In these obliged links the relation with the DRA is omitted. In other words if Kadaster want to relate these two datasets it is their own responsibility. Since the cadastral boundaries are mostly measured relative to buildings it more obvious to focus on the BAG (only addresses and buildings) than the BGT (all topographic information). But there is an important difference between the building geometry of both registrations. For the BGT only the footprint of a BAG building needs to be measured up. That means that only the geometry of the ground surface is of importance. For the BAG-building the geometry of the circumference need to be measured. This can be above or below ground surface. In most of the cases the geometries of both of the registrations are the same, but there occurs inequalities with the subsistence of enterable volume above or below the ground surface (Ministry of I & M, 2015). In figure 2.5 the both geometries are compared based on an apartment block. As can be

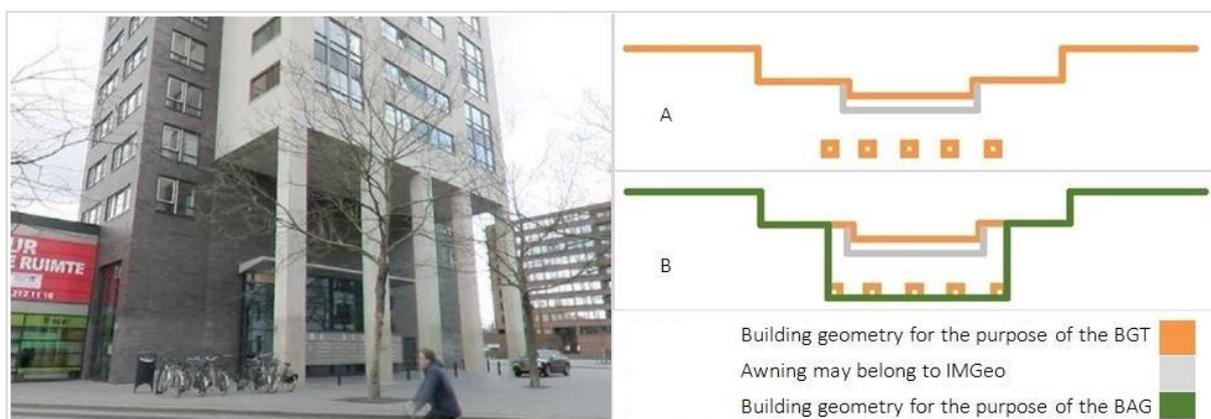


FIGURE 2.5: DIFFERENCE IN GEOMETRY BUILDINGS BETWEEN BGT (A) AND BAG (B)

seen starting from floor three and higher there is an extended construction on pillars. The measuring for the BGT registration is only on ground surface while the measuring of the BAG is made with a top view perspective. This is why the BAG registration is not always complete enough for the points out of the DRA, those are relative to ground surface objects. Moreover it is important to take notice of the current plans for linking the buildings in the BGT more direct with the BAG buildings.

A representative of Kadaster about the difference between these registrations:

“[...] you’ve got the BAG, which contains buildings, but those are different than in the BGT, to increase the revelry. [...] What you will see is that these topography products, the BRT, BGT, BAG, but also (air)imageries, are going to fuse into one ‘family’. Eventually you can use the for your purpose relevant topography for the visualisation or relating purposes. This is going to take a while because of the current rules and regulations.”

Currently there are initiatives for the inventory of how to deal with the differences between the two registrations. One proposed solution is making use of linking surfaces introduced by a couple of software suppliers. It should results in an one-time gathering and multiple use principle, so lower costs and a higher quality of these data what leads to better information and policy making (KING,2014).

To make the scheme of key-registers extra complex there is also the Waardering Onroerende Zaken (Valuation of Immovable Property, WOZ). Properties are valued by the municipality in accordance with this valuation (Rijksoverheid, 2015). This registration does not have geographical component yet. In September 2013 there was a meeting with the municipality of Venray, Geonovum, Waarderingskamer and three commercial parties. The goal was to come up with an approach for keeping track of the geometry in favour of the WOZ. After a discussion the participants agreed on the following issues:

- Integral signalling of geometric mutations of the WOZ-surfaces.

The municipality of Venray wants a match between the factual situation (WOZ) and the cadastral situation (BRK). By differences there must be feedback and corrected by Kadaster (Reuvers, 2013). But this is a sensitive topic because the cadastral map is not legally binding and Kadaster treat it as such; therefore the reconstruction archive is needed, as explained in section 2.1.1. Another issue is described as follows:

- There must be aimed for a better semantic consistency between the BGT, BAG and WOZ registrations;

By aligning information (semantics) out of the different standards will lead to a so called ‘Request for Changes’ (RFCs) for the various standards. This will better align the information in the linking surfaces.

Unclear cadastral information has an influence on taxes and WOZ. It encourages land grabbing by civilians but also by municipalities (Reuvers, 2013). For example, a municipal cycle lane which runs through someone’s parcel. In most of the times it is without premeditation, but it creates confusion when it happens and can result in a difficult conflict. A possible for improvement for the system of key-registers is making the open data linked. Abhilakh Missier (2015) demonstrated that already a lot is possible with linked open data in the municipality of Rotterdam. It still needs some development; also to profit from the actuality of the data by making it linked on-the-fly. It is inevitable that more and

more key-register will be linked data and connected according to the logical links and the OGC (Open Geospatial Consortium) standards. Kadaster has to anticipate by looking how the cadastral map can be linked with the BGT.

2.4 | SUMMING-UP

What stands out in this section is the fact that a lot of parties are involved in the large scale topography and to lesser extent in the cadastral map of the Netherlands. For now, the link between the two maps is small and has been bigger during the alignment of the cadastral map on the GBKN. This consistency is lost due to not combining or fine tuning the workflows. Nowadays there have to be dealt with, geometric differences, boundaries that not coincide with topography because of updates of the cadastral map and the large scale topography. But also different motives between the involved parties for further cooperation. Regarding the development of cadastral registrations, in recent history, there have always been a clear difference between the cadastral map (geographic part: indicative, complete, inaccurate, graphic) and the accompanying reconstruction archive (descriptive part: relative, accurate, terrestrial). The current vision of Kadaster is to aim for a more positive character by integrating the archive more and more in the map.

A lesson that can be learned out of the realization of the BGT is that it is appreciated by the BGT registry holders that the role of Kadaster is reduced. This is in contrast with the situation during the building of the GBKN, where Kadaster had a multiple role and the wishes of the municipalities were underexposed. It is one of the reasons why Kadaster currently only have a role as distributor. Another reason is the fact that the current registry holders are at the same time the biggest users of their local part of the BGT. This increases the sense of responsibility.

This section also described the connection between the different key-registers with a geometric element. The WOZ, BAG and BRT are all closely linked but are not all usable for alignment with the cadastral map. Only the BGT has up to know the right properties, depending on the geometric accuracy.

Besides the system of key-registers will be getting more important. Thereby the amount of mutual links will increase. The possible advantages of the system will increase in the process of time. Think of automatic updates by linking the different key-registers according to the OGC standards.

The next chapter focuses on current motives of BGT registry holders to pursuit a certain quality there regional large scale topographic map. But also the vision of the registry holders on Kadaster and possible cooperation will be elaborated; besides the user needs will be inventoried.

3 | INVENTORY NEEDS REGARDING GEOMETRIC ACCURACY

This chapter will handle both polls set out for the inventory of the motives of the BGT registry holders and the users of the cadastral map for a certain geometric accuracy. The focus lays on the consistency of topography with cadastral boundaries but also how the registry holders look at eventual cooperation. In the first section a description is given of the structure and content of the polls. Subsequently the analyses of the poll send to the registry holders can be found. Section 3.3 will focus on the user needs concerning the cadastral map. The last section will give a summary of this chapter.

3.1 | DESCRIPTION CONTENT AND PURPOSE OF THE POLLS

Poll BGT registry holders

The poll intended for the BGT registry holders can be found in the appendices (A1: Poll BGT registry holders). It is structured as follows; the first questions are used to categorize the respondent. In the succeeding questions the specific knowledge, opinion and the users of the BGT areas are getting inventoried. The last part focuses on possible cooperation with Kadaster. Among other things the opinion of the registry holders towards Kadaster are mapped. In the end 274 of the 440 addressed parties opened the link to the poll. Unfortunately, due to an error in the used software a great amount (63) of cases are useless for this research because the data did not get recorded after question 4 (areas in grey figure 3.1). What also may have played a role is the fact that the individuals who opened the poll found out after question 4 that they needed more and specific knowledge. After filtering

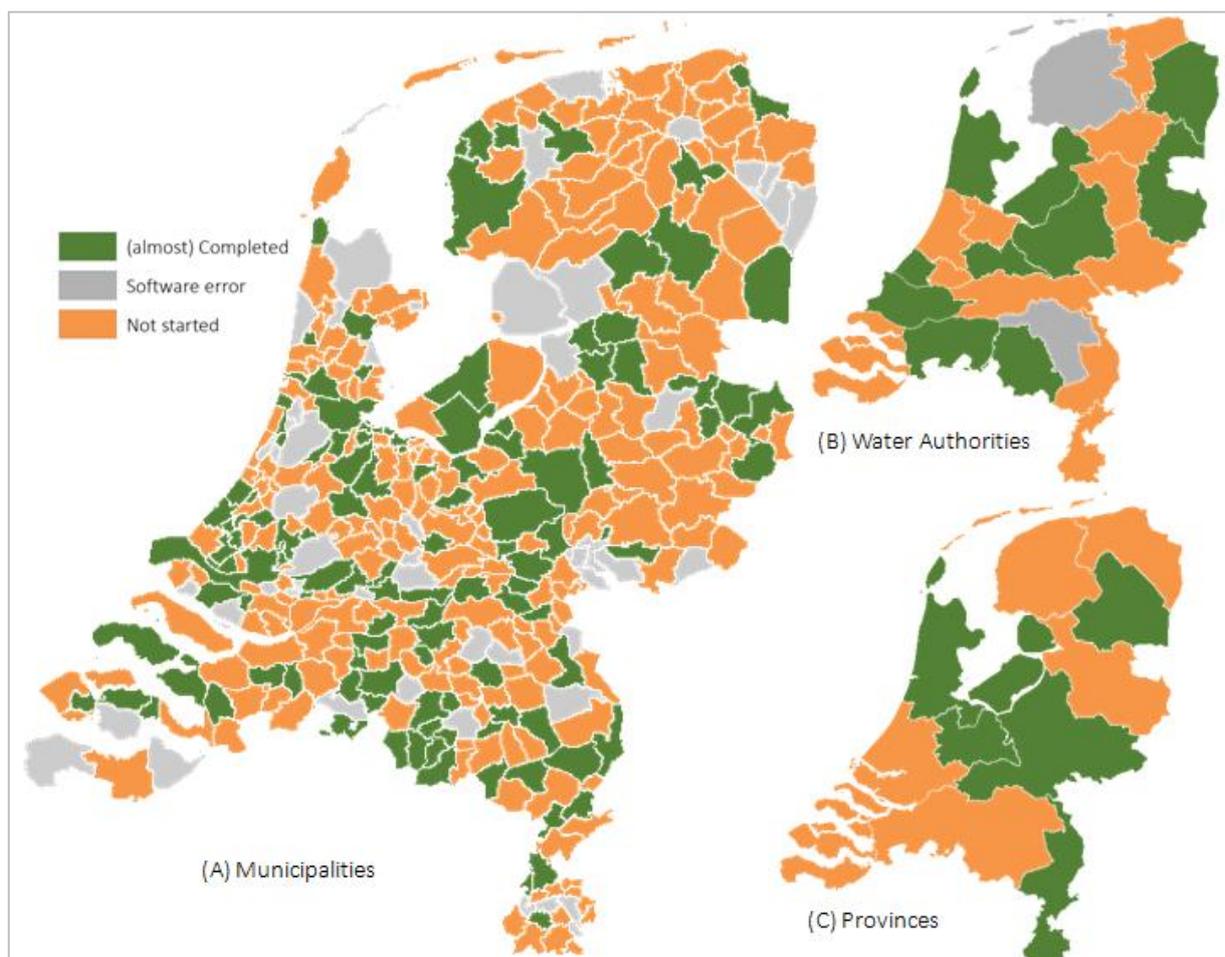


FIGURE 3.1: REGISTRY HOLDERS THAT (PARTLY) COMPLETED THE POLL DIVIDED BY MUNICIPALITIES (A), WATER AUTHORITIES (B) & PROVINCES (C)

these and the (largely) blank results 136 respondents remained. In the end 125 registry holders completed the whole poll and 11 only the first half about the geometric quality of the BGT in their area. As visualized in figure 3.1, 116 municipalities (A), 10 water authorities and (B) and 6 provinces (C) (almost) completed the poll. Besides the Ministry of Defence, Ministry of I & M, Ministry of Economic Affairs and Rijkswaterstaat completed the poll. Only one respondent is not a registry holder, namely the ministry of I & M.

Poll user needs cadastral map

Another poll was send to all the users of the cadastral map up to one year back. It can also be found in the appendices (A2: Poll user needs cadastral map) and consists of fifteen questions. The purpose is the inventory of the user needs of this map. The questions are structured in a way that becomes clear which kind of user it is, for what purpose he or she needs the cadastral map and what the particular needs are. The poll was sent to 14.555 the primarily commercial customers. With a response rate of 13 percent, 1876 users successfully participated in the study. This does not mean that every respondent has answered all the questions; some were optional because of the complexity of the terminology.

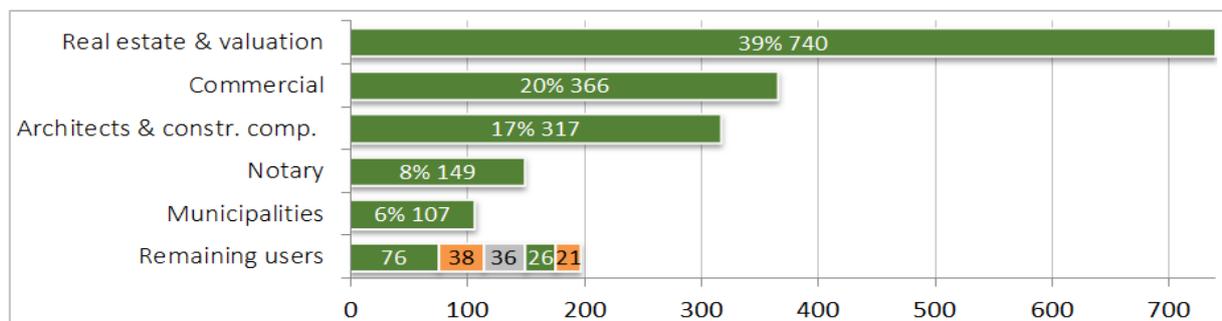


FIGURE 3.2: USER GROUPS IN ABSOLUTE NUMBERS AND IN PERCENTAGES. REMAINING USERS (10%) ARE DISTINGUISHED BY RESPECTIVELY 'OTHERS' (4%), 'ADVOCACY & CONSULTANCY' (2%), 'GOVERNMENT & UTILITY' (2%), 'HOUSING ASSOCIATIONS' (1%) AND 'PRIVATE USERS' (1%).

It was not always clear what kind of answers to expect, in advance. At some questions the option 'otherwise, namely:' was added for the inventory of new categories. That is why the questions 1, 3 and 4 are re-categorized afterwards, so for the most part these answers can also be analysed. The options for user groups are now ranked by the number of respondents: 'Real estate & valuation' (740), 'Commercial' (366), 'Architects & construction companies' (317), 'Notary' (149), 'Municipalities' (107), 'Others' (76), 'Advocacy & consultancy' (38), 'Government & utility companies' (36), 'Housing associations' (26) and 'Private users' (21). See also figure 3.2.

The options for frequency are re-categorized in: 1 or more times a 'day' (141), '-week' (779), '-month' (555), '-quarter' (206), '-year (43)' and 'Variable' (134) and Only once (18). As can be seen (figure 3.4) 80% of the users buy an abstract of the cadastral map on monthly, weekly and daily basis.

The purposes of the users are divided in 'Purchase, sale & valuation' (772), 'Global overview' (385), 'Permits' (230), 'Others' (196), 'Research & analyses' (149), 'Input GIS' (75), 'Input zoning plans' (47)

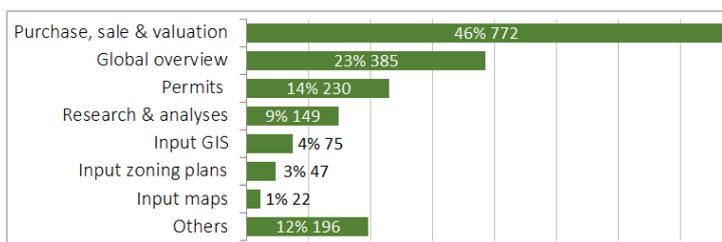


FIGURE 3.3: PURPOSES CADASTRAL MAP

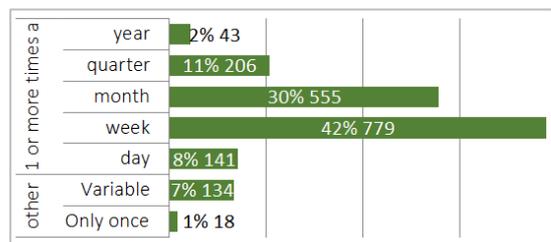


FIGURE 3.4: FREQUENCY OF PURCHASE

and 'Input maps' (22). See also figure 3.3. These options can be weighed against for example the need for a certain geometric accuracy for a certain purpose. With all these classifications the analyses can be better managed.

3.2 | ANALYSIS OF RESPONSES OF THE BGT REGISTRY HOLDERS

At the beginning of the poll the registry holder could indicate in which extent they have the knowledge of geometric quality of their territory. If they have none, they are directly looped to the questions about cooperation (§ 3.2.2), this turned out to be 14 respondents. Subsequently 88 representatives were really confident about this particular knowledge and 34 doubted, but attempted to fill in these questions about geometric accuracy (§ 3.2.1).

3.2.1 | GEOMETRIC QUALITY

Areas classified into geometric accuracy

For the registration of the quality of the cadastral map after the possible fine tuning with (parts of) the BGT is essential to know the quality of the used BGT (see also section 1.1.2). The registry holders have indicated that how accurate they measure is dependent on the type of topography (Ministry of I & M, 2014). That is why the focus lays on the hard topography (buildings and civil engineering work) because the geometry of these objects is used for the relative points of the Digital Reconstruction Archive (DRA). The registry holders are asked to divide their area in the different ranges of geometric quality to a maximum of 100 percent (see figure 3.5). According to the poll 37 percent of the buildings in the BGT (will) have a geometric accuracy of 2 to 5 centimetre.

For 25 percent a 5 to 10 centimetre, 24 percent 10 to 30 centimetre and 14 percent is unknown. The subsequent question asks for the ambition of the registry holder for the geometric accuracy of the

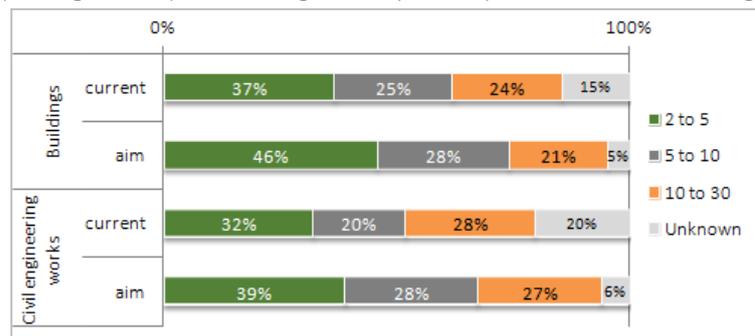


FIGURE 3.5: PERCENTAGES HARD TOPOGRAPHY CLASSIFIED INTO GEOMETRIC ACCURACY

buildings. In this matter the distribution is as follows; 46 percent of the area is of a 2 to 5 centimetre accuracy, 28 percent of 5 to 10 centimetre, 21 percent of 10 to 30 centimetre and 5 percent unknown.

Taking the civil engineering works as reference points (bridges, overpasses and tunnels) the indicated actuality and ambition is lower. For the geometric accuracy of 2-5, 5-10, 10-30 and unknown the area is subdivided in respectively 32, 20, 28 and 20 percent. The ambition is a little bit higher and respectively 39, 28, 27 and 6 percent.

Around one third of the buildings and civil engineering works are measured with a 2 to 5 centimetre precision. The ambition of the registry holders is even higher. This information in combination with the local knowledge of the geometric accuracy, Kadaster can use those specific BGT areas for an update of the cadastral map. Unfortunately the accuracy of 14% and 20% of respectively the buildings and the civil engineering works is unknown. For possible try-outs there can be relied on the BGT's of the Ministry of Defence and the municipalities of Purmerend, Súdwest Fryslân and Lelystad. These parties indicate that 100% of their buildings in the BGT areas are measured with a 2 to 5 centimetres geometric accuracy. Besides, three of them also promise that 100% of the civil engineering works are

measured with a 2 to 5 geometric accuracy. Another 19 registry holders are aiming to reach a percentage of 90 to 100% of measurements with a 2 to 5 centimetre precision for their buildings.

But how broad the concept of hard topography is underlines a representative of the municipality of Rotterdam. He describes in an interview the quality of their BGT:

“The hard topography, the frontage of buildings, are almost all terrestrial measured. Maybe there are buildings in the harbour area, oil tanks, obtained from the photogrammetry. [...] As well as the rear end of buildings are not with a precision of 2 to 5 centimetre.”

For Kadaster the measurements of a whole building are of importance. There is a change that the respondents distinguished the front and back-side of buildings, which reduces the value of above results. This is also a comment of a couple of the respondents, that there is a difference in the geometric accuracy of the measurements between urban and rural and front and back-side of a building. Uniform quality can for this reason not be guaranteed. Yet the answers on the questions still give a good indication on how the different registry holders rank their own area and if they have that specific knowledge anyway. There can be assumed that the registry holders are aware of the quality their own BGT, but they also indicate that it is various. Add to this that there are many registry holders in certain areas what will result in an increase of the differences.

Motives for geometric accuracy

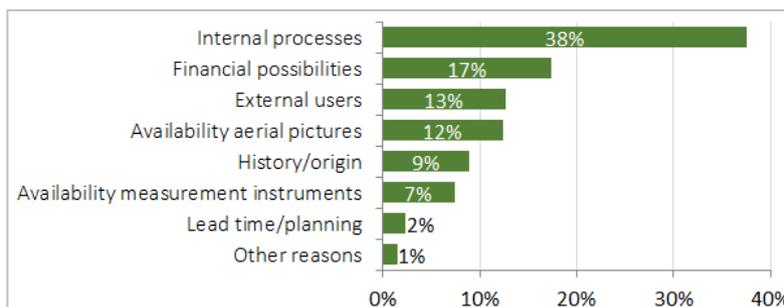


FIGURE 3.6: FACTORS THAT DETERMINES GEOMETRIC ACCURACY

and availability aerial pictures (12%), history/origin (9%), availability measurement instruments (7%), lead time/planning (2%) or other reasons (1%) (see also figure 3.6). Notable is the fact that lead time or planning is not really an important factor regarding the choice for a certain geometric quality. Even with the approaching deadline of the BGT. The opposite was true during the accelerated digitization process of the cadastral map in 1994, because there was a clear demand for a digital map. Nowadays the internal processes as green and road maintenance are according to the given answers leading to pursuit a certain geometric accuracy. This creates vicious circle, where an internal motive is stronger than an external, the demanded quality will be sooner pursuit. What also stands out is that the financial possibilities of a registry holder highly determine which accuracy can be obtained. Is there enough money for hiring an external company or extra personnel? This is indirect a political factor where city councils and ministries decide which budget goes to which department. The demand of third parties, as Kadaster, is also seen as important. This is also kind of obvious, because companies rely on the quality of the supplied products of the registry holders. Their processes are created on basis of certain geometric accuracies.

Another question for the registry holders is to which extent the described motives are a factor for pursuing a certain accuracy. From most to least important the respondents answered as follows: Internal processes (38%), financial possibilities (17%), needs of external users (13%)

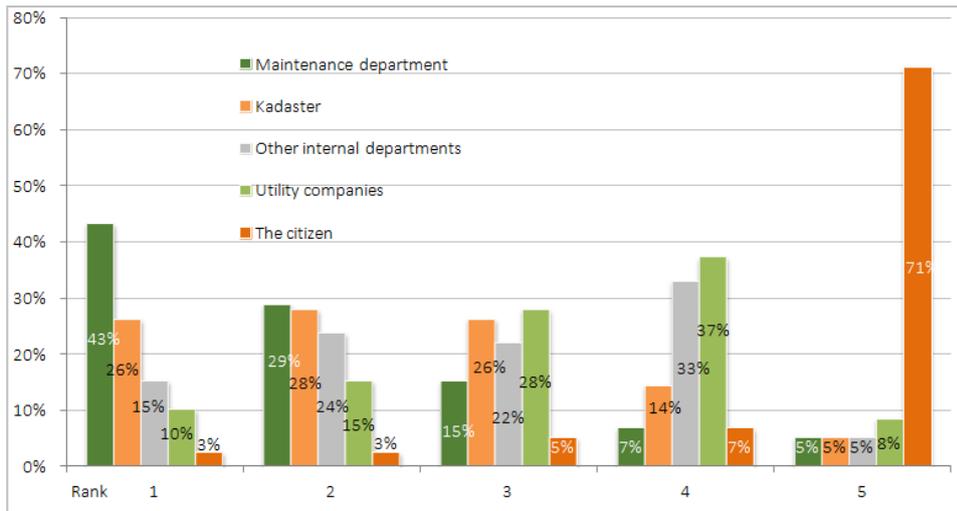


FIGURE 3.7: PARTIES RANKED BY INTEREST IN BGT WITH A 2 TO 5 CENTIMERE PRECISION

But for who is a 2 to 5 centimetre precision of importance in the eyes of the registry holders? In the poll the respondents had to order the different parties from rank 1 to 7. In the graph rank

seven and a the second option for 'Other parties' are omitted because they were for 97% linked and only completed three times (architects, other companies and researchers of universities). The first 'Other parties' option is also omitted and was complemented with among other groups 'other external users' (7 times), other governmental organisations (2 times) and two times the suggestion that no party have this interest in an area-wide measured BGT with a 2 to 5 centimetre precision. Figure 3.7 emphasizes that the greatest interests comes from the maintenance department. This is confirmed by a representative of the SVB-BGT:

"I notice an enormous willingness at municipalities to invest in the map (BGT). [...] Internal management processes are an important motive for the municipalities, especially the BOR (Beheer Openbare Ruimte, Management Public Space)."

According to the registry holders Kadaster is second party with most interest in a BGT with 2 to 5 centimetre precision. For that matter they have correct interpretation of this poll. Kadaster is indeed trying to live up to this specific quality. Subsequently other internal departments are also graded high. Regarding the utility companies it is remarkable that it is put mostly on the 4th rank, the interest is limited in the opinion of the registry holders. The 5 utility companies who filled in the user needs poll (see section 3.3) do not give a clear answer in this matter. Another inquiry is needed to get that clear. In the last years of the GBKN they had the greatest financial allocation-key of all concerned parties. But that was not necessarily due to the pursuit of a certain quality, but more for a base map in general. This question did not have the option to not rank a party. This is a minus for the results, it means that according to the registry holders there is a clear ranking in who has the most interest, but it does not give information about which parties does not have interest at all. For example the citizens are graded lowest, but even if they wanted, the respondents could not ignore this group.

But in general do the registry holders want that the geometric accuracy of the BGT must be increased? The reactions on this question are visualized in figure 3.8. The answers are quite divided, most registry holders a neutral and are satisfied with the current geometric standards of the BGT. But still a large group (totally 12%) agrees (35%) that the geometric accuracy must be increased.

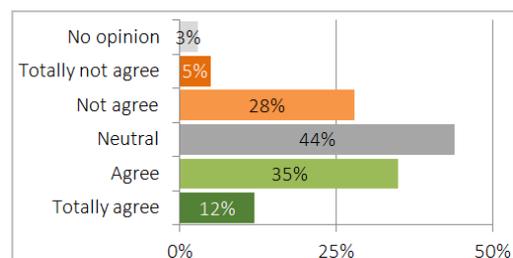


FIGURE 3.8: THE GEOMETRIC ACCURACY OF THE BGT MUST BE INCREASED

Now it is clear what the motives of the BGT registry holders are the next section will address their interest in cooperation with Kadaster.

3.2.2 | INTEREST IN COOPERATION WITH KADASTER

How to cooperate?

In the poll distributed by SVB-BGT directed to the BGT registry holders they are also asked how they think about possible cooperation. One of the questions asked was if they are interested in closer cooperation in the area of the BGT and the cadastral map. Thereby they are also asked for practical recommendations for how to configure this collaboration. 34 percent (43 registry holders) of the respondents see no necessity for further cooperation. The used arguments differ from 'lack of time' and 'we have not enough capacity for additional tasks' (9 registry holders) to 'there is no direct link' and 'these are two complete different registrations' (13 registry holders); The deadline for the BGT gives no space for in this currently discussion. Part of this research is to come up with some clear and practical recommendations. This will result in more willingness by the registry holders. A representative of the SVB-BGT thinks it is not the right time to discuss cooperation:

"I think they (BGT registry holders) are always open to discuss improving their map, but not on short notice."

He refers to the approaching deadline of the BGT and it is confirmed by the respondents. 24 percent (31 registry holders) of the respondents have motives for closer cooperation and 41 percent (53 registry holders) only after the realisation of the BGT. How they see that practically that differ, most have to admit that they have no idea; 'Cooperation is always interesting, but how?'. One respondent describes one of the intentions of this whole research 1-on-1 map:

"The BGT could be the fundament for a geometric better and more consistent cadastral map".

Others are more concrete 'Through bundling the accuracy of both registrations', 'joint file improvement, in the city centre for example' and 'Kadaster delivers locations with cadastral mutations. Those measurements need to be accepted by registry holder for certificates.' Other ideas are linking the BGT-ID with the parcel-ID, cooperation in the surveying of buildings and linking it with the Waardering Onroerende Zaken (Valuation of Immovable Property, WOZ). In short, there seems to be interest in combining topographic with cadastral surveying work. This will be further elaborated in section 4.2 about possible cooperation forms.

Subsequently 65 answers are given on the question what Kadaster can do to help the registry holders maintaining or distributing the BGT. What becomes clear reading this notices is that 11 of these respondents say that Kadaster has nothing to offer in favour of the BGT; but, there is also clear need for a combined mutation process of the cadastral and the topographic map and a freely exchange of this data (5); besides there is a need of freely available survey data. By all means there is a need for a more accurate cadastral map. One of the respondents indicates that in that way it can be used as a tool in the maintenance of the BGT. But there are also annoyances regarding obsolete data (2) and cadastral registrations of poor quality (8). Besides, as said before (section 2.1.2) the 'quality features' are recently disembodied from the digital cadastral map. The registry holders (2) would appreciate it if the link with the 'quality features' will return. But this is also the wish of Kadaster, so currently there are running some analysis how this could be reintegrated in the system. Furthermore there were

some reactions that Kadaster is not well informed about its own products. This feeling among registry holders can interfere with further cooperation. Kadaster should keep this in mind if there are now clear reasons why a registry holder deter rapprochement.

Exchange of local knowledge/expertise

Cooperation is also profiting from the capabilities and knowledge from each other. The project manager of the 1-on-1 map is clear about the possible advantageous of cooperation:

“ [...] but in the whole construction process, it is in fact quite good if you involve people with knowledge of a certain area. Perhaps they also know the quality of the cadastral map in that.”

This feeling seems to be correct according to the poll. On the question, if there are employees in the organisation who have knowledge of the current cadastral map in their area, 50 percent of them answer this in a yes, for the whole area. 30 percent say that they have knowledge of the cadastral map in a part of their area. Only 10 percent of the respondents do not have the knowledge of the quality of the cadastral map in their area. Another 10 percent do not know if they have the particular knowledge. They gained this knowledge by working many days with this specific data. The cadastral boundaries are compared with their own administration. For a municipality it is essential to know how much of their terrain belongs to their management area. This means that a qualitative good cadastral map is of great importance. It determines how much to budget. A representative of the municipality of Rotterdam:

“ I see potential for a form of cooperation; we have a lot of cadastral knowledge. There are employees really engaged in property registration. I think that our knowledge of the area and the field can be used for the clean-up of the cadastral map in Rotterdam. [...] taking care of assigning the good location to the boundaries.”

But what is already mentioned in previous section is that there is a need for the availability of the of the survey data of Kadaster out of the Digital Reconstruction Archive. Especially now the ‘quality features’ are no longer provided, they want to know what the quality of the map is. More transparency by Kadaster is desired.

The next section will be a focus on the needs of the users of the cadastral map. Sometimes these are also the BGT registry holders, but often different apartments.

3.3 | ANALYSIS OF THE RESPONSES OF THE USERS OF THE CADASTRAL MAP

As indicated in section 3.1 another poll was sent to all the cadastral map users of the last year (20-05-2014 to 20-05-2015). Not all the questions were intended for this research so these will be ignored, unless there is a link to the subject of this thesis. The section is divided in three parts; the first focuses on geometric accuracy and the second on the consistency with the topography and the last on other comments called in the responses of the poll.

Geometric accuracy

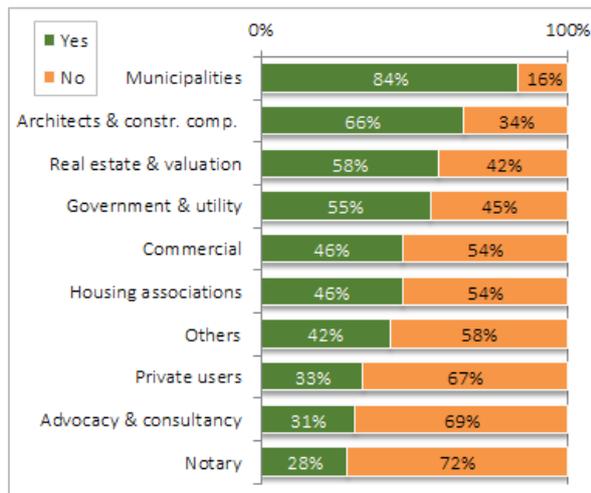


FIGURE 3.9: DIVIDED BY USER GROUPS; IS THE DEGREE OF GEOMETRIC ACCURACY FOR THE CHOSEN/DESCRIBED PURPOSE OF IMPORTANCE

neighbourhood were looped to the next question. There is assumed that for this purpose a certain geometric accuracy is not important and are so classified as 'no'. For the public notaries a certain geometric accuracy is of least importance for their purposes according to the poll. Almost three quarters of the notaries have answered the question with 'no'; this in contrast to the municipalities where 84% of the respondents have answered the question with 'yes'. So for the municipal usage of the cadastral map the geometric accuracy is of importance (figure 3.9).

For Kadaster one of the factors that play a role in the decision for another improvement of the cadastral map is the need of the user. It is clear that an improvement of the geometric accuracy will cost a lot of money. This improvement will have positive impact on the internal processes of Kadaster, but is it also of importance for the other (external) users? Thereby, one of the main purposes behind the poll is to discover possible differences between the user groups regarding the need for a certain geometric accuracy. The respondents who filled in that the main purpose of their abstract of the cadastral map is to get a global overview of the parcel and its

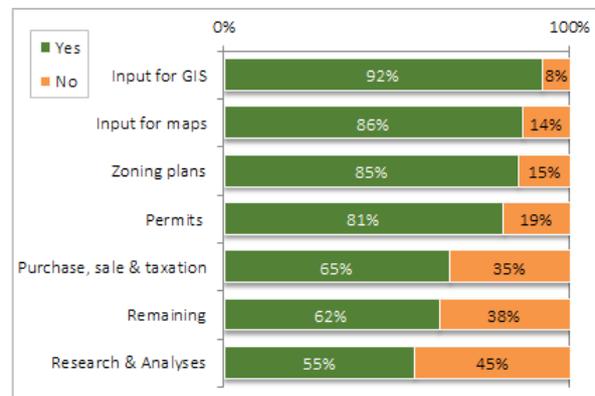


FIGURE 3.10: DIVIDED BY PURPOSE; IS THE DEGREE OF GEOMETRIC ACCURACY FOR THE CHOSEN/DESCRIBED PURPOSE OF IMPORTANCE

Regarding the purposes a certain geometric accuracy is most of importance when it is used as input for a Geographical Information System (GIS). For research and analyses slightly more than half attach value to it (figure 3.10).

Geometric accuracy is of importance for the purpose where they use the map for according to 1022 (49%) respondents. Of these users 48% desire an accuracy of 2 to 5 centimetres, 33% desire 5 to 10 centimetres, 12% desire 10 to 20 centimetres and 8% (87 respondents) percent desire an accuracy of 20 to 30 centimetres. These results say that for only 87 of the respondents that have a certain desire the current set standard geometric accuracy of the cadastral map ($\sqrt{2} \cdot 20$ cm in urban areas and $\sqrt{2} \cdot 40$ cm in rural areas, see also section 1.5) is of sufficient quality; assuming that the cadastral map meets the standards nationwide; thereby there can be assumed that the users who use it for a global overview of the parcels and its neighbourhood can be added to this number. But still, it can be seen as a clear call from the user for a cadastral map with higher geometric accuracy, the current standards are too high.

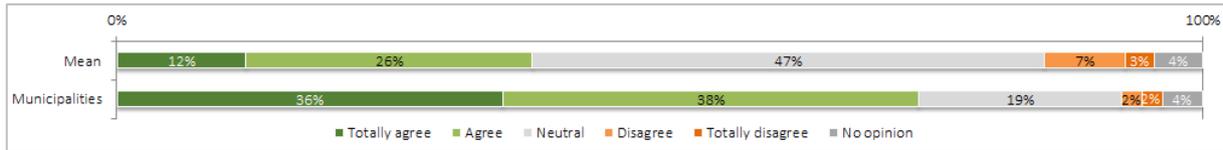


FIGURE 3.11: THE GEOMETRIC ACCURACY OF THE CADASTRAL MAP NEEDS TO BE INCREASED

More directly the respondents are asked about their opinion about the geometric quality of the cadastral map. Only 9 percent do not think that the accuracy needs to be increased. The employees of the municipalities are even more certain that this increase has to be realized in the near future. 36 percent totally agree and 38 percent agrees with the sentence (figure 3.11).

The question about the (potential) properties of the cadastral map gives an extra confirmation. It shows a clear view of what is considered as less and what is considered as more important. The users are asked to put accuracy, actuality, consistency and completeness in the right order of

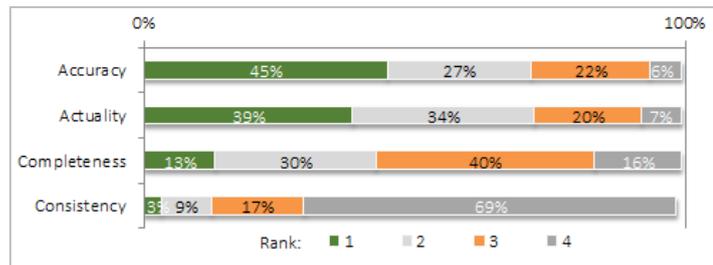


FIGURE 3.12: PROPERTIES CADASTRAL MAP RANKED ON BASIS OF IMPORTANCE

greatest importance for their proceedings. Most of the respondents find the consistency with the underlying topography (average rank of 3.54 with a maximum of 4) of the least important. 69% (948) of the respondents put consistency on rank 4. Subsequently the completeness (average rank of 2.6) is followed by actuality (average rank of 1.96). The accuracy is considered as most important with an average rank of 1.89. Respectively 45% and 39% of the respondents rank it as 1 and 2 on the scale of importance. Again the municipality user group shows aberrant values. For them actual is more meaningful (44% rank 1 and 34% rank 2) than accurate data (32% rank 1 and 18% rank 2). It is important to keep this in mind by developing a plan for the update of the cadastral map. There is a greater need for geometric accuracy than for consistency with the topography. But keep in mind that ultimately two accurate maps are automatically consistency.

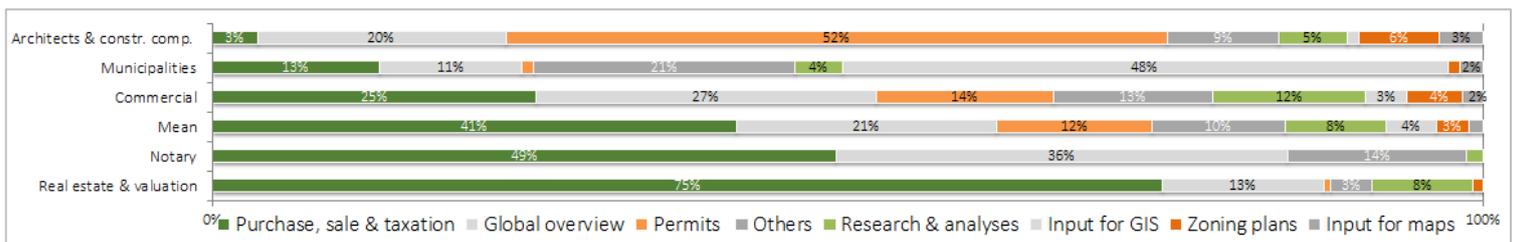


FIGURE 3.13: USER GROUPS COMPARED WITH PURPOSES OF THE CADASTRAL MAP

If the user groups are compared with the different purposes a couple of groups stand out as can be seen in figure 3.13. As said, the purchase of an abstract of the cadastral map is mostly done by real estate brokers and valuers (742, 40%). There can be notified that they primarily need it as an appendix of the property report for sale, purchase & valuations of real estate (75%). Thereby 58% find the geometric accuracy for their purpose important (see Figure 3.9). Commercial parties (366, 20%) use the cadastral map most of the times to obtain a global view of the parcel and the surroundings (27%), purchase, sale & taxation (25%) and permits (14%). Construction companies and architects

(317, 17%) mostly use the cadastral map for licenses (52%) and for a global view of neighbouring parcels (20%). This comparison gives an indication why certain groups need a certain precision. The municipalities use it mostly for their GIS (48%), and architects and construction companies for permits (52%). These two purposes require a high accuracy. See also Figure 3.10. Next section will focus on the consistency of the cadastral map with the topography.

Consistency with topography

Despite the fact that consistency is seen as less important than geometric accuracy, actuality and completeness, it does not rule out that topography is needed for orientation in the cadastral map; inconsistencies will always show up. But maybe the submitted buildings with the cadastral map are not required. To test this assumption the respondents are asked for their opinion on the following sentence: *With the supply of the cadastral map the topography can be omitted.* 9 percent of the

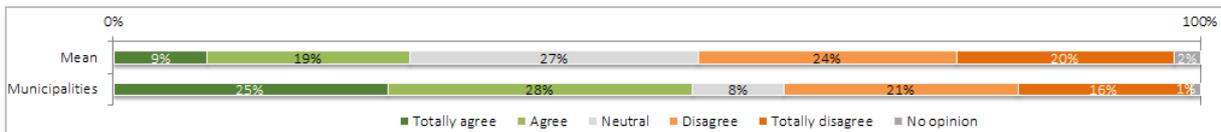


FIGURE 3.14: WITH THE SUPPLY OF THE CADASTRAL MAP THE TOPOGRAPHY CAN BE OMITTED

respondents totally agree, 19 percent agree, 27 percent are neutral, 24 percent disagrees, 20 percent totally disagrees and 2 percent have no opinion (figure 3.14). This is a notable result; only 28% of the respondents have no interest in the supplied underlying topography. Analysing the opinions of the different user groups the municipalities have a significant deviation. From the 107 respondents 27 totally agrees (25%), 30 agrees (28%), 9 are neutral (8%), 23 disagrees (21%), 17 totally disagrees (16%) and 1 has no opinion (0,9%). Apparently the underlying topography is of less important for municipalities according to more than the half of this user group. One of the reasons is that 31 of these respondents use the cadastral map as input for their GIS. Most of the times this means that it is implemented as a layer on their own datasets. In other words, the acquired topography is superfluous because they have their own.

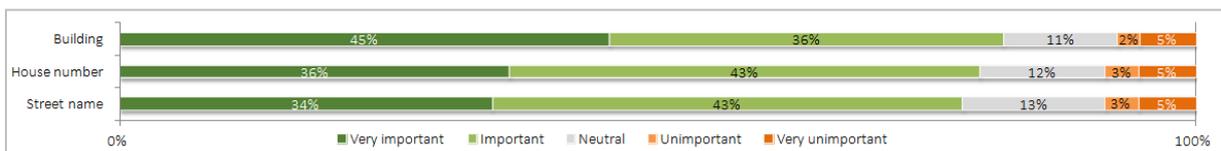


FIGURE 3.15: OPINION ABOUT INCLUDING BUILDINGS, HOUSE NUMBERS & STREET NAMES WITH CADASTRAL MAP

But getting more specific the users even have more interest in the supplied topography with an abstract of the cadastral map. This conclusion can be made analysing the answers on the question how much value is attached to the supplied buildings with the cadastral map. 81% of the respondents find the supply of buildings important (36%) to very important (45%). The semantic data like street names and house numbers are also seen as important (both 43%) to very important (respectively 34% and 36%). See also figure 3.15. Again the municipalities are less definite and see the supplied buildings, house numbers and street names as less important. 35 percent label it as (very) unimportant.

Finally, the following sentence gives food for thought: *There should be no difference in geometric accuracy between the cadastral map and the underlying topography.* It looks like stating the obvious but it makes even clearer that consistency is important for the largest group of users, but it is not

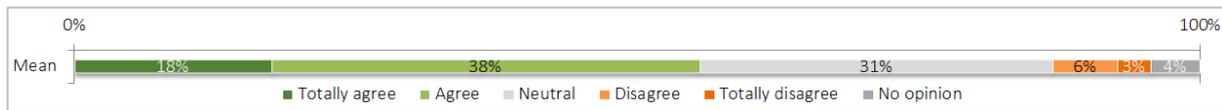


FIGURE 3.16: THERE SHOULD BE NO DIFFERENCES IN GEOMETRIC ACCURACY BETWEEN THE CADASTRAL MAP AND THE UNDERLYING TOPOGRAPHY

important for everyone (figure 3.16). Despite the fact that accuracy, actuality and completeness are seen as more crucial, the interest in consistency may certainly not be underestimated.

Résumé, on the basis of the multiple choice questions can be concluded that there is a clear need for consistent topography supplied with the abstract of the cadastral map. Figure 3.12 shows the only exception where accuracy, actuality and completeness are labelled as more important. Focussing on the comments on the various questions of the poll will give an insight whether the current differences between the cadastral boundaries and the hard topography creates confusion.

Other comments

In one of the last questions the respondents are asked for other comments. 284 users gave a reaction. Because the poll was made in cooperation with product and process maintenance of Kadaster, most of the reactions are complaints regarding the (lack of) scaling possibilities (79), the options for receiving different file extensions (22), billing and the high prices for an abstract of the cadastral map (46). Besides there are needs for the old supply chain (7), annoyances about on the lack of supporting browsers (20), but also some compliments (25). These notes are extremely valuable for Kadaster, but not directly for this research.

There are 34 of these 284 comments about consistency with topography and other key-registers. The comments differ from a distinct need for combining more information from the BGT (parking lots and cycle lanes), BAG (numbers and addresses) and development plans, but also the wish for a closer link with the digital reconstruction archive. One of the reactions about linking the key-registers:

“Semantic information is important in order to understand the situation in the map. But with the system of key-registers is the BGT eventually the preferred source for the visualisation of this. The ‘old cadastral map’ will be in due course replaced by combined visual presentation of the key-register the user wants. PDOK will be used for presenting it for the layman in a simple way.”

Apparently the users also think of possible solutions:

“Regarding the accuracy of the boundaries, you could give it several colours or shades; for example, how darker the line, the more accurate the border.”

Giving the boundaries a different colour or a different thickness that is a detail in possible solution what need to be further elaborated. It is important to notify that this issue also cross the minds of the users. There is even an idea for a 2.5 dimensional cadastral where the different apartment rights can be distinguished. A 3D Kadaster does not exist anywhere, but there need to keep an eye on the developments in this field (Stoter & van Oosterom, 2006). It is also one of the focus points of Kadaster

in the near future. The cadastral map has to better fit with other registrations and with the Bouw Informatie Model (Construction Information Model, BIM) (Salzmann, 2015). The BIM is a working method for an integral cooperation by several disciplines in the construction sector (Het Nationaal BIM Platform, 2015). Another interesting comment is about the unique way of working of Kadaster in the scheme of key-registers:

“Put the cadastral map as a WFS-service in PDOK and you deliver services. Kadaster is a commercial party in the chain of key-registers. This can be prohibitive by delivering open data in the long term.”

As part of the chain of key-registers it is obvious that there will be a search for cooperation between the different registry holders. Is there a need for consistency in geometric accuracy? The respondents who agreed or disagreed on the statement that the geometric quality of the cadastral should be the same as the underlying topography had the opportunity to further specify their choice. 221 respondents that agreed and 62 who disagreed on this statement gave a specification. What becomes clear out of the comments of who disagreed is that a couple of users are convinced that the cadastral map is accurate and that inconsistencies are due to the quality of the supplied topography (15). So it is not the responsibility of Kadaster. One of the comments regarding this topic:

“The topography is inaccurate, when this is know it is not a problem. It is essential that the cadastral registrations are accurate.”

For a lot of respondents the brand ‘Kadaster’ still is another word for certainty. What prevails is that cadastral borders belong to be of good quality, the topography is only for orientation. They are unaware of the fact that the geometric accuracy of the GBKN or BGT is sometimes higher than that of overlaying cadastral map. This also shows the difficult balance of Kadaster between letting sleeping dogs lie and becoming more transparent about their products. Probably the poll already sends a signal to the users.

As among the BGT registry holders also a couple of users are sceptical (30). The maps are completely different. It is not worth it to spend money and time for making the cadastral map consistent with the underlying topography. These are quite in the minority; looking at the comments of the users that agreed on the statement a clear signal (125 comments) emerges. The accuracy is of great importance and inconsistencies may not occur. If dissimilarities occur the customer wants an explanation, which is hard to explain and result in unnecessary irritations, confusion, disagreements and discussion. A nice example from the comments:

“If you have a watch at your disposal, you know exactly what time it is; if you have two watches you do not know what time it is.”

Which watch is correct? Maybe both or neither? Thereby if for both maps the geometric accuracy is the same, for example 2 to 5 centimetre, the unaligned combination will have a lower accuracy. Besides, it just does not look nice. Nevertheless there is a clear call for an increase of the quality of the cadastral map. 58 respondents who disagreed and 205 who agreed on this statement did write a comment to clarify their choice. Two of the main reasons for the need of a qualitative update are that it allows more precise measurements (60) in the cadastral map, but it also raises fewer questions at the end user (55). The products need fewer explanations.

3.4 | SUMMING-UP

This chapter is an analysis of the polls to the BGT registry holders and the users of the cadastral map. Structuring the enormous amount of responses gives an indication about the needs of the users and the BGT registry holders.

The aim of most of the registry holders to measure their buildings and civil engineering works with a 2 to 5 centimetre precision (respectively an average of 46% and 39% of the areas) is promising for Kadaster. There are even registry holders which have measured or aiming to measure all of their hard topography with a geometric accuracy of 2 to 5 centimetre. These BGT areas can be used for an update of the cadastral map. Only footnote is that there are a lot of differences between the measurement methods of the different BGT registry holders. Some only measure the frontage of a building with a 2 to 5 centimetre precision and as the information models describe there is a difference between urban and rural measurements. This also still applies for the cadastral map (see section 1.5). Because the registry holders are mainly aiming for a certain geometric accuracy for their own department Kadaster can profit from this internal motives.

What stands out is that most of the municipalities, provinces and water authorities are interested in further cooperation; even more after the realisation of the BGT. Think about doing measurements together or the exchange of knowledge. The registry holders are interested in survey data out of the Digital Reconstruction Archive and Kadaster is interested in the local knowledge of the registry holders; especially knowledge about the regional quality of the cadastral map.

Regarding the users there is a clear difference among the different groups in purposes and needs of the cadastral map. For the municipalities is the degree of geometric accuracy essential (84%), for the notaries is it less important (28%). But overall, ranking the different abilities of the cadastral map accuracy is seen as most important, than actuality, than completeness and consistency is ranked 4th by most of the respondents. Given the limited possibilities of answering the matching question there can be argued about the amount but not on the sequence of the outcomes. Yet, regarding the consistency, the reactions on the questions show that users experience a lot of confusion by their customers.

The next section will return to the primary theme of this research. Is there a common pursuit for cooperation which can contribute to more consistency between the cadastral map and the large scale topographic map? The results out of previous chapters will be discussed.

4 | SEARCH FOR A COMMON PURSUIT

Although this research deals with a form of cooperation instead of a whole new information infrastructure, it echoes on the research of Koerten (2011). This chapter focuses on the presence or absence of a narrative anchor which links time, technology and territory.

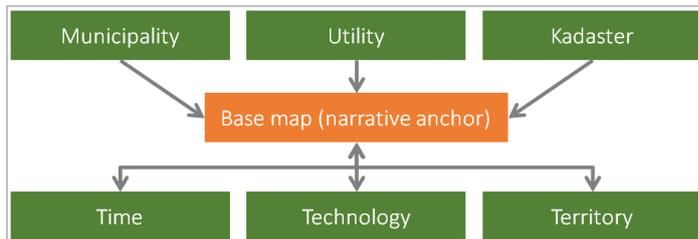


FIGURE 4.1: NARRATIVE ANCHOR GBKN (ADAPTED VERSION, ORIGINAL KOERTEN, 2011)

The success of the GBKN was due to a shared effort for a base map suitable for three parties. Municipalities needed a very accurate base map to visualize its own territory as accurate and up to date as possible. According to Koerten utilities could do with limited, less accurate base maps only for an

indication of their cables and pipes (some interviewees disagree and say that the front of the building were only of importance for the utility companies). Kadaster was finally satisfied with something in-between, a reasonable accurate base map (see figure 4.1). The pursued goal was the same, and survived despite developments in time, technology and territory.

During issues regarding asylum in the Netherlands in 2015 the Dutch government had to make a statement on what to do with the asylum seeker. That cabinet consists of a political party of the right wing (VVD) and a political party of the left wing (PVDA). Eventually they came up with a political statement (the so called 'bed, bath & bread regulation') what needed to be explained at their electorate back home. So two political parties who have completely different views on matters had the same solution what could be explained differently. Is there such a narrative anchor for creating an optimal balance between cadastral map and the BGT? What is in it for the different involved parties? Or is the scheme for key-registers of the Netherlands the anchor and is the link between the BGT and the BRK just a part of it? This chapter will cover these questions.

The first section will focus on the willingness of the concerned parties to participate and the second section will go deeper into these possible forms of cooperation. The last section will sum up the information of this chapter.

4.1 | WILLINGNESS FOR COOPERATION IN CREATING MORE CONSISTENCY BETWEEN BOTH MAPS

Because of the fact that Kadaster is the client of this research it is obvious that they see virtue in possible cooperation in creating more consistency between both maps. The intended benefits are clear, alignment with BGT regions with sufficient geometrical quality will result in a more accurate cadastral map. On the other hand Kadaster is obliged to make use of the BGT. As said in section 2.3 there is no necessary link from the BRK to the BGT. Although it seems obvious it had to be asked for the completeness of this research. The cadastral map is abstract and the boundaries or parcels not necessarily correspond with topography. In fact, the map can in this way not be of any help for the realisation of the BGT. An employee of Kadaster puts it as follows:

"In fact, that the cadastral map cannot be used for creating the BGT, that is right. In that sense, that the cadastral map follows the topography is a logical development."

As said in section 3.2.2 there are registry holders who see in a cadastral map with a high geometric accuracy advantages, a potential tool, for the BGT. But the prevailing feeling is that the cooperation

cannot be a kind of exchange program. When looking at what BRK with high geometric quality can do for the BGT the answer will be negative. There is insufficient support from BGT registry holders for cooperation only on basis of these two key-registers. This makes it necessary to zoom out and look at the total scheme of key-registers.

The juridical and thus economic arguments lie in the accuracy of the demarcation of the area under the responsibility of a registry holder. A municipality needs to reserve budget for maintenance costs for the green and road management. How more positional accurate the information provided by Kadaster how more reliable the budget can be estimated by the financial department. What is of whom can be seen as the core business of Kadaster and in that sense there is enough confidence in their expertise. A representative of Dataland:

"I can also see that some of the people at Kadaster want to do more than the tasks given to them through the government. Kadaster has a particular task, let them do it right; in this case cooperation with the organisations that are registry holder. I want to work with them, cooperate and not be taken over."

What emerges from this quote is that caution is needed by propose to take care over certain tasks. For example: making a bid for becoming the 8th registry holder of the BGT. Perhaps the intention is good; to fill in the areas where the other registry holders fall short. Think of nature areas as the Veluwe. But for others it appears to be that Kadaster want to attract more power. It can even arouse suspicion among small parties, like Dataland. They do not want a new boss so Kadaster has to behave like they are equal or even lower in hierarchy.

In this matter it is important to take a look at the situation from more distance; In other words looking at the whole scheme of key-registers under responsibility of I & M and not just one part of it. What came up in most of the interviews is a trust in the concept of key-registers. In a way it can be seen as the narrative anchor as the 'base map' was in the case of the realisation of the GBKN. In a column on iBestuur (a platform for information management of the government) Teeffelen (2015) uses the term 'map language'. There is a need to speak the same map language in form of the BGT. Until recently there were different maps with substantial differences. Therefore there arose confusion on regularly basis over which map serves as base map and which one is the most reliable.

An often heard feeling and an obvious one is: what's in it for me? Besides there is not enough trust in the knowledge at Kadaster of their cadastral map. A formal employee of the municipality of Amsterdam involved in a project of Kadaster and the municipality in aligning the two maps:

"The municipality tried, in close cooperation with Kadaster, to align the digital cadastral map with the digital base map (GBKN) of Amsterdam, between 1992 and 2000. This project cost a lot of money and did not end well. I don't think you can figure out what the quality is of your boundaries. I'm really convinced about this opinion. According to the 'propagation act' the whole increase of the value of data will be unsatisfactory when the base is not right. I know examples of boundaries that are measured with GPS precision, 5 centimetre, and are now fluctuating between the 30 and 40 centimetre precision."

As said in section 2.1.2 even the quality controllers of Kadaster cannot exactly say what the quality is of the cadastral map. So the feeling of the representative of the municipality is right. It is various and

depends on region and its history. Kind of remarkable is that this knowledge is not available at Kadaster, but comes also as a surprise for some of the employees. In this way it hard to regain trust:

“Cooperation depends always on the confidence in each other and being transparent. Being transparent is difficult, trust easily disappears if something appears to be not good.”

What can be seen as an advantage together a disadvantage is the size of Kadaster. As explained (section 2.2.2) the reputation of Kadaster was not always flawless. The reaction of a representative of SVB-BGT also witnesses:

“We had trouble in the past to work with Kadaster. It is a complete different party. You notice that they are not really up to the development of an information system. As a small organization we are pretty agile. Besides we have good people employed who want quick development.”

Kadaster is less dynamic because of two reasons, it is a semi-governmental organization and it is retained by its size. In return it is a party what is financial highly capable and it developed and manages some very complex, well protected information systems (among other things PDOK, LKI and AKR). Another condition for a solid form of cooperation is equal rights according to an employee of Geonovum:

“In the past cooperation was based on the guarantee that the project would reach its finish. But cooperation only exists if the power is divided. Al the parties are equally important. That is the price of our democracy.”

Kadaster kind of voluntarily missed the train to become a registry holder of the BGT but its role in the system of key registers is considerably. With among other things the responsibility for PDOK, Key-Register Topography (BRT) and Key-Register Kadaster (BRK) it is an important institution. There lays the entrance to profit from each other its capabilities and create a system what becomes more efficient. Thereby the reputation of Kadaster is positively improved appears out of the interviews and the responses to the surveys. Also most of the BGT registry holders want to cooperate with Kadaster. The only question is how to cooperate.

4.2 | COOPERATION FORM

First of all, is it really a problem that there is a lack of consistency between the cadastral map and the BGT? More and more people will notice it and in that sense it will become self-dissolving problem as during the GBKN:

“Confront, make the differences visible. In that way people realize it may not occur, there must be intervened. This was the procedure during the last phase of the GBKN”

According to the conducted polls and interviews the problem is already notified and creates confusion and annoyances, so there must be intervened. The following steps can be taken; if Kadaster will use the same method as during the project map improvement it will result in a good alignment with the BGT. The two risks that follow are that good cadastral map parts can be made worse by a BGT of poorer quality. On the other hand the current cadastral map aligns far from everywhere with the BGT/GBKN. That means that the two working process where not consistent. Differences occurred with

every new mutation. Not only of mutation in the cadastral map but also in the large scale topographic map. A representative of SVB-BGT:

“If, for example, you want a curb on the cadastral map with an accuracy of 2 to 5 centimetre and the layer under it does not have that accuracy and you make use of the reconstruction archive and put the boundary correct and then the BGT is not adapted then it is obvious that you get different interpretations. You will see to things that should be the same as to different geometries. With the last alignment (project map improvement) is tried to eliminate that kind of situations. It is important to keep the consistencies. If you improve geometrically you have to process it in the source data. At this moment I do not think the registry holders are up to cooperate with this procedure.”

This interviewee emphasises that the BGT registry holders are currently too busy with realizing the BGT to engage in these issues. What is underlined is that the value of source data cannot be underestimated. It is essential that the basis is in good condition. It is unavoidable that cadastral map has to connect to this BGT, because it does not seem to be a temporarily phenomenon. It is the future of (governmental) geographical information systems. Therefore, a system has to be developed that continuously detects differences between topography and cadastral map. On this basis it gives signals to the registry holders. If the registry holder decide it is correct it will be adjusted. This is a rough concept how such a system should function, but eventually the (future) workflow need to be designed in a way that it takes care for enduring alignments and no single alignment.

In good consultation with the registry holders a lot is possible for Kadaster; from test areas to discussion groups. The technical possibilities are hard to enumerate. Kadaster is still figuring out what is possible and what not. For example with every reconstruction of a cadastral boundary a small part of the topography is also measured up with a 2 to 5 centimetre precision:

“[...]we get with measuring boundaries scattered everywhere also a small piece of topography with GPS and NETPOS (Netherlands Positioning Service) and everything really accurate on the right spots. Why should we only use it and not also other parties that could benefit from it?”

Is this valuable for the BGT registry holders? This possibility coincides with making the survey data freely available. Some registry holders have indicated that they want access to the reconstruction archive because they regularly make use of it. But this will have (financial) consequences for the working processes of Kadaster. Strictly it is data only for internal purpose and is certainly not open data, but it can be provided by Kadaster. Currently users have to pay to make use of survey data, but maybe this relatively small loss of income is worth becoming more transparent as Kadaster. There are also other parties who measure with a 2 to 5 centimetre precision. Construction companies and architects for example have to design their building plans pretty accurate. They do this according to the previous called BIM standards. Such a database would perfectly fit into the trend that more information becomes available and Kadaster will become a more transparent institution.

In exchange of these survey data Kadaster could make use of the local knowledge of the cadastral map what is present at the BGT registry holders. These interventions are all part of the bigger picture, to give the user clear, consistent and hopefully accurate products. To realize this, the role of the different

parties has to change and there have to come more focus on the primary capabilities of the different institutions. Where the registry holders excel in local manpower and knowledge, does Kadaster stand out in providing a nationwide platform and developing and managing complex data systems.

There is common pursuit for increasing the accuracy of the cadastral map and make it consistent with the topography. Nevertheless this cannot be seen as a narrative anchor where the several parties want to work for and make it to a success. This is twofold, the registry holders are too busy to put time in this goal and on the other hand they expect from Kadaster that they make the first move. This first move is to inventory the current state of the cadastral map and making a plan for linking the reconstruction archive closer to the cadastral map. Furthermore as said in the sections 2.2.2 and 3.2.2 Kadaster have a certain image that could play a role in reaching understanding. It could even interfere creating a minimal form of cooperation, based on trust, exchanging data and work separately. Not mentioning reaching a maximal form of cooperation consisting of doing (surveying) work together and developing systems for automatic data exchange.

To reach complete consistency there cannot be worked with double obtained data. Topography that coincides with parcel boundaries has to be surveyed only once. To realize this Kadaster have to outsource their measurements or their boundaries get an extra attribute; if it coincide with topography (decided by the surveyor) it should automatically be integrated in the BGT. The other aim of Kadaster toward a more positive system with the project 1-on-1 map is connected with the consistency. People rather put faith in a consistent map than when they see dissimilarities. So the advice of Kensing (2011) is still valid that it is not worth putting time and money in making the cadastral map 1-on-1 when the underlying topography remains the same.

In a way the overall system of key-register can be seen as a narrative anchor. Throughout all the interviews and in big amount of comments in the conducted polls emerges the collective trust in the system. It will take a couple of years before it will function optimally, but the principles are solid and promising. Still there has to be a thought about linking the key-registers with a geographical component most ideal; in such a way that it is really meets the 'one-time gathering, multiple use' principle. It provides consistency, efficiency and cost savings.

4.3 | SUMMING-UP

This section was a short reflection on the previous chapters, where it has become clear that the making the cadastral map geometric more accurate and more consistent with the topography is the responsibility of Kadaster. The BGT registry holders have indicated that they wanted to cooperate, but are not yet in the position to be of any help. Kadaster has to inventory the condition of the cadastral map. If Kadaster wants full consistency with the underlying topography it is only possible if topographic elements that coincide with parcel boundary are measured once for both datasets. Afterwards the BGT registry holders can in consultation with Kadaster decide to increase the geometric accuracy. Important to notify is that with a closer link with the topography and if changes are made in the BGT it also affects the property boundaries. There should be paid attention to this in the design of the accompanying workflow.

5 | CONCLUSIONS & RECOMMENDATIONS

The conclusions are divided among three sections; summary, recommendations and ultimately the suggestions for further research.

5.1 | CONCLUSIONS

The conclusions below are structured in order of the chapters so following the different research questions.

Kadaster has the ambition to give the cadastral map a qualitative improvement. This research is an analysis to which extent the BGT and its registry holders can be of help. The ultimate goal is to increase the geometric accuracy, but also to get more consistency with the underlying topography.

Map improvement

The cadastral map and the large scale topographic map (GBKN & BGT) have a history of respectively 183 and 30 years. The maps were aligned starting in the end of the 1990ties. This project 'map improvement' resulted in a 'nice' map image where the lines were visualized more consistently. It met the most explicit user needs, a digital nationwide map. The degree of geometric accuracy however, increased but also deteriorated in certain areas. Most of the times the GBKN was leading and the cadastral boundaries were adapted on it. It fulfils its purpose as an index to the reconstruction archive.

Currently the cadastral map is really diverse and the quality fluctuates depending on how, where and when the measurement is done and if it was subject to (digital) transformations. The quality is not always known by Kadaster, thereby the 'quality features' are temporary no longer inventoried because it caused too many misunderstandings.

The successor of the GBKN, the BGT, is (and will be) also quite varied. The more than 400 different registry holders all work with the same standards, but those standards are multiple interpretable. Based on experiences of the involved experts it can be assumed that it will take several years to approach homogeneity. The primary reasons for this are that the measurement methods can be different and are sometimes outsourced, but also all the different BGT-areas with several registry holders responsible have to intertwine. It is like a big puzzle where all the pieces need to be polished at the borders before they fit in each other.

The first research question of this section focuses on the results of project 'kaartverbetering':

1. a. *To what extent was the result of 'project map improvement' of Kadaster an improvement of the cadastral map?*

As said, project map improved had mixed results for the geometric accuracy of the cadastral map. Furthermore, the alignment with the topography at that time is still visible comparing the current maps, but this consistency decreases over time.

The second question focuses on the current quality of the two maps and how both are related:

- b. Which improvements can still be achieved for the cadastral map and the BGT and to what extent can both registrations help each other to realize this?*

Because there are fluctuations regarding the geometric accuracy of both maps makes it hard to estimate the potential mutual dependency. It is clear that both maps can be improved but not necessarily with the help of each other. It is for example an option to keep the maps up-to-date with the help of high resolution imagery and ortho photos. Now with the new system of key-registers, imposed by the Ministry of Infrastructure and the Environment, the both maps are perforce brought together. In addition, other key-registers (WOZ, BRT and BAG) must also be taken into account. Another factor that needs to be notified is the (mis)understandings between the BGT registry holders and Kadaster. The several parties have a history which can get in the way of further cooperation. Most issues like distrust and grudge seems to be perished, but can unwittingly play a role.

Inventory needs regarding geometric accuracy

Besides focussing on the properties of the two maps this research is also an analysis of the needs of the registry holders of the BGT and the users of the cadastral map. What is evident from the responses of the poll is that there is a clear need for more geometric accuracy of the cadastral map. Furthermore there is an even greater need for clarity about the (measurement) details of a cadastral boundary.

The second research question examines the motives of the BGT registry holders for the pursuit of a certain geometric accuracy.

- 2. What are the drivers and barriers for a BGT registry holder to pursuit a certain geometric quality?*

The responses on the poll directed to the BGT registry holders gave insight in the motives to pursuit a certain geometric quality. Internal processes are seen as most important, followed by financial resources and external users. Lead time and planning is seen as least important.

The eventual geometric accuracy of the hard topography (buildings and civil engineering works) in the BGT is indicated on an average of 35% measured with a 2 to 5 centimetre accuracy and the aim is to reach an average of 43%. Looking at the individual cases there are registry holders who realized or are aiming to measure 100% of the hard topography in their area with a 2 to 5 centimetre precision. In other words, promising test areas for Kadaster.

The poll proves that there is a great interest in cooperation with Kadaster in the field of geometric accuracy. Moreover, a great number of respondents have indicated that they want to wait with cooperation till after the realisation of the BGT. This new key-register asks a lot of time of the registry holders.

Among the registry holders there is a lot of specific knowledge about the quality of the cadastral map. This knowledge is absent for some regions at Kadaster. The registry holders gave some input on how to cooperate with Kadaster. Valuable comments are for example; working together with surveying. A condition for cooperation is that Kadaster has sorted out the condition and quality of the cadastral map. This will give an insight on how BGT can be used giving the cadastral map a qualitative update. .

The third research question focuses on the user needs:

3. *Which user groups can be distinguished in terms of the desired accuracy of the cadastral map and is there a need for consistency with the underlying topography?*

Regarding the users of the cadastral map there is a clear need for an improvement of the geometric accuracy of the cadastral map, mainly the municipalities. For their purposes the degree of geometric accuracy is the most important. The notaries use the abstract most of the times to get a global view of the parcel and its neighbourhood. For that purpose the geometric accuracy is not that important. Nevertheless the currently set standard of the geometric accuracy of the cadastral map is too broad according to the users. Only a few respondents are satisfied with the current quality.

Consistency with the underlying topography is seen as less important than completeness, actuality and accuracy. Nevertheless, the poll addressed to the user shows that there are a lot of annoyances about inconsistencies. It is hard to explain the dissimilarities between both maps to the customer.

Search for a common pursuit for cooperation

The last section takes up on the dissertation of Koerten (2011). He wrote that a narrative anchor would survive time, technology and territory. The following research question is derived from his methodology:

4. *To what extent is there a narrative anchor as a base for cooperation?*

Such an anchor is not found in the potential cooperation on increasing the geometric accuracy. There is not (yet) a collective purpose, first Kadaster have to inventory the status of the cadastral map. After that the BGT registry holders can be of help by joining in test areas. This research has demonstrated that the first step is making the map consistent with the underlying topography. There should be one party who does the measurements and makes the decisions about which boundaries should coincide with topographic elements. If total alignment is realized there can be looked for possibilities of using the expertise of both parties to increase the geometric accuracy of both datasets.

In a way this is in line with the philosophy of the system of key-registers, what can be seen more as a narrative anchor. The users, interviewees, Kadaster and registry holders have expressed their confidence in the system. They believe in the purpose of the system, an efficient one-time data provision. It is a promising system because the entire government have to work with it. There can be assumed that it will develop further and will, as a whole, become more and more consistent. This is partly because it is imposed by law but also because the benefits are becoming more apparent.

Overall conclusion

Finally with all the information gained by literature, interviews and polls an answer can be formulated on the main question:

What form of cooperation, at an organizational level, between Kadaster and the registry holders of the BGT can contribute to more consistency between the cadastral map and the BGT?

This research made clear that the geometric accuracy of both the cadastral map and the BGT are quite variable. Comparing the two maps shows that there are parts that align well and parts that show big differences. Making both maps more consistent with each other and the reality is a complex challenge. The different involved parties (registry holders and Kadaster) showed willingness for working together. It does not mean that there is a narrative anchor for cooperation, because consistency between the cadastral boundaries and its underlying topography is of less importance for the BGT registry holders. Nevertheless the users of the cadastral map ask for more accuracy and (into a lower extent) also more consistency; but the main need is clarity. To offer clarity Kadaster has to know all the (measurement) details of its own cadastral map. So, communicating the right quality features and not supplying conflicting information. Subsequently this information gives the right basis for cooperation with the BGT registry holders and they need to provide the same details in return. It should contribute to the necessary mutual trust. The next step is comparing the two maps in certain test areas where the geometric accuracy is unequal; there have to be decided which topographic elements should coincide with a cadastral boundary and which of the two maps is most accurate and should be leading. Besides, these tests should give answers on how the workflow should be designed. For a decisive answer there can be made use of other tools as highly accurate ortho photos and satellite imagery. This joint comparison should lead to information about feasibility and the development of standards. Given the interest Kadaster have to initiate this project and is responsible for the implementation. Eventually, as long as the survey data is not directly integrated in the cadastral map confusion will continue to occur. Even with a cadastral map consistent with the BGT. However it is less noticeable and only become visible with a boundary reconstruction.

5.2 | RECOMMENDATIONS

The following recommendations can be made as a result of this research.

Offering clarity

Regarding the 1-on-1 map project Kadaster has to create an organisation wide vision on what to do with the cadastral map; a broad-based message that can be carried out to the outside world. At the same time shows this study that users of the cadastral map and other involved parties have different opinions about this map. It has to be more consistent, complete, actual but above all more accurate. However the main desire is clarity. What instruments is being worked with and what quality does the cadastral map have? How are the boundaries measured, by whom and on which date? A great part of these details are part of the so called 'quality features'; which describes what method is used and with what precision. Indirect this is a plea for creating a closer link between the cadastral map and the digital reconstruction archive. Ideally there is no dissimilarity in quality between one and another area, but this takes time and is therefore hard to realize. In the mean time Kadaster has to communicate what they know and has to figure out what they do not know. BGT registry holders and other involved parties will automatically gain trust in Kadaster as a partner to cooperate with.

Upgrade cadastral map with every new measurement

With the current abilities of the used instruments can be expected that the quality of the cadastral map improves with each new measurement. Though, these accurate measurements will also be implemented in the less accurate cadastral map. Possible solution: improving the (less accurate) cadastral map with (more accurate) measurements instead of the reverse. This was also recommended by Bennekom-Minnema in 2008 but it did not yet have been fully implemented. The standards are often tight enough, but there is a need for a tighter control on the measurements (geodetic quality checks) and eventually it takes time to approach homogeneity.

Use the geometric more accurate parts of BGT

A promising tool in this matter is the (upcoming) BGT. The geometric accurate areas can be used for an update of the cadastral map. A number of issues must be considered in this matter. First, there must be figured out which parcel boundaries should align with the underlying topography. Thereby the hard topography (buildings and civil engineering works) need to be distinguished from the soft topography (boundaries of ditches). Hard topography is often measured more accurate. On the other hand Kadaster need to evaluate which parts of the cadastral map are of sufficient quality and do not need an update. It is not advisable to do again a one-time clean up as in the map improvement project. In order to prevent dissimilarities in the process of time it is essential that the workflows will be adjusted to keep the data sets aligned. This means that (new) topographic elements that coincide with cadastral boundaries must be measured only once or should be automatically linked through an extra attribute code.

Integrate cadastral map in system of key-registers

Most of the registry holders support the ambition of Kadaster to give the cadastral map an improvement. This support can be put into practice by starting a discussion group. In the poll a couple of respondents said they wanted to join such a group to discuss the possibilities for further cooperation. It is a rather complex process what asks for some technical but also some organisational solutions. In a way this is imposed by the ministry of I & M through the system of key-registrations. It

asks for a one-time gathering and a multiple use of data. The BGT is the base map and the other registrations with a geographical component have to connect with these. There must be aimed for a better semantic consistency between the WOZ, BRT, BAG, BRO and BGT. But also with the key-register Kadaster (BRK) which contains the cadastral map. It would be fully in line with the philosophy of the key-registers that a part of the cadastral map is integrated and can be used from the BGT. Every topographic element that coincides with a cadastral boundary should have an attribute which links it to that line. This will have legal consequences, despite the fact that the cadastral boundary is not always the legal boundary it is often seen as the same. So the displacement of the parcel boundary will have influence on the owned surface of the involved property owners. It must be handled with great care. That is why Kadaster will keep an important role to ensure this. This makes a total transition of the responsibility for the surveying work probably impossible, but in any case it could be subject of discussion.

Create database 'throwaway' sketches

There should be a kind of database wherein companies and Kadaster could upload their survey data even as the 'throwaway' sketches of construction companies; in case of Kadaster making the DRA available for other parties. Often measurements are made for own purposes and are only used once. If these calculations are all saved in one overall easily accessible cloud among others the registry holders could make use of it.

5.3 | FUTURE RESEARCH

The next four issues could be further elaborated and are interesting subjects for further research.

How to optimally link the different key-registers?

There is already done quite some research in the field of the system of key-registers (among others Stoter, 2013). The conducted research is primarily done on the information model side, while the real issues of this research lays on the content side. There are probably some ongoing analyses on how to fine tune the semantics of the key-registers with a geographical component. What is evident from this study that alignment of datasets is making better use of the governmental information. The gathering will be more efficient and the information can be reused more often. Another important reason is that the data that represents the same elements can be collected and managed only once. This prevents inconsistencies. There should be looked at possibilities for the BAG, WOZ, BRT, BRK, BRO (Basisregistratie Ondergrond, Key-Register Subsoil) and the BGT. Examples are open-, linked and used data, but also VGI as tools to handle the big data consisting of these different datasets; creating a dynamic connection between key-registers. As said in previous section some of the registry holders have indicated that they want to get involved in a discussion session about further cooperation on how to get more consistency with the cadastral map and the BGT. Moreover, the conclusions and recommendations of this thesis can be used for the session.

Visualisation options in differences of geometric accuracy

Another element that needs to be further elaborated is how to visualize differences in geometric accuracy in the cadastral map. As suggested; if the quality is known they can be varied with line thickness and colours. For example a thin line represents an accurate boundary and a thick line an inaccurate one or a green boundary represents a 2 to 5 centimetre precision and a red line graphical precision. By all means the user wants clarity and this is one of the opportunities that possibly can give them that. Further research can examine which visualisation options are the most appropriate, but also how to supply other information as measurements details and qualitative features.

What is technically possible?

This research has focused on the organisational part of creating an accurate and consistent cadastral map, but inevitably a lot of technical issues play a role in finding an organizational format. For example, what is the role of up to date ortho photos and other modern alternatives, like laser scans and height-data. As been said it can be used to figure out if cadastral map or the BGT is 'correct' in case of differences. In that case it functions as a neutral referee. Furthermore, is there still a need for a nationwide large scale topographic map or are ortho photos with a high resolution satisfactory. Besides the suppliers of surveying software will not stop innovating. If the demand is made known, they will sooner or later come up with a tool what will help aligning the cadastral map with the BGT. There is a lot of money at the governmental organisations who are involved in the system of key-registers. It is within reason to assume that the alignment of different datasets will become easier in the future, even with different data measurements methods. Are the governmental organisations overtaken by technology wile busy with the key-registers? What are the possibilities of the current techniques for surveying work and aligning different datasets? These questions need to be investigated.

Declaring cadastral boundaries identical with topographical elements

What is mentioned several times in this research is that some cadastral boundaries should coincide with a topographical element; for example, the sidewall of a building or the sidewalk of a road. How this can be declared should be subject for future research. What needs to be figured out are both the technical consequences (what is the content of the information model; how to integrate it with the Spatial Data Infrastructure (SDI); which software modifications should be carried out?) as the organisational consequences (who does surveying, editing, management and distribution; what changes in the workflows, does the topography changes, cadastral boundary or both?)

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INTERVIEWEES

Interviewee	Function	Organisation	Date
Jos Anneveld	Partner	Aerovision	29-05-2015
Jan Bruijn	Director	SVB-BGT	21-04-2015
Hans van Eekelen	BGT IMGeo management	Geonovum	31-03-2015
Eric Hagemans	Geodetic expert	Kadaster	17-04-2015
Frank Kenselaar	Author of the research report 'Het nieuwe meten inpassen'	Municipality Rotterdam	13-04-2015
Klaas van der Hoek	Process Owner BRK	Kadaster	10-04-2015
Henk Koerten	Author of the dissertation 'Taming technology, The narrative anchor in geo-information infrastructures'	VU Amsterdam	24-04-2015
Adrie Noorlander	Transition Manager	SVB-BGT	13-04-2015
Martin Salzmann	Director Strategy and Policy	Kadaster	01-06-2015
Louis Smit	Chairman Department Manager Key-information	Meeting BGT Registry holders Municipality Rotterdam	07-05-2015
Pieter van Teeffelen	Director	Dataland	26-05-2015
Hiddo Velsink	Geodetic expert	University of applied sciences Utrecht	02-04-2015

APPENDICES

A1: POLL BGT REGISTRY HOLDERS

The reactions on this poll are used in section 3.2; the analysis of the responses of the BGT registry holders.

Geachte bronhouder,

Het kadaster heeft de ambitie om de geometrische kwaliteit van de kadastrale kaart verhogen. Een belangrijke reden voor deze hogere kwaliteit is het verkrijgen van een betere onderlinge ligging tussen grens en topografie. Afstemming en samenwerking tussen kadaster en bronhouders BGT ligt dus voor de hand. Het Kadaster is opzoek naar eventuele dwarsverbanden met het inwinnen van topografie en kadastrale grenzen. Deze enquête heeft als doel de mogelijkheden tot samenwerking tussen het Kadaster en de BGT bronhouders te inventariseren. De enquête zal ongeveer 10 minuten van uw tijd vragen.

Alvast bedankt voor de tijd en moeite,

Namens het Kadaster,

Alexander Boersema

Student Geographic Information, Management and Applications
boersema@gmail.com
06-49924573

Categorie bronhouderschap:

Gemeente

Provincie

Waterschap

Landelijke organisatie

Naam bronhouder:

Vorige

Volgende

Voor het Kadaster is informatie over de **geometrische nauwkeurigheid** van de BGT van essentieel belang. Onder positionele nauwkeurigheid wordt volgens de gegevenscatalogus BGT verstaan: de mate waarin de opgeslagen coördinaten overeenkomen met de waarden in de werkelijkheid of de geaccepteerde afwijking. De positionele nauwkeurigheid in de BGT is de combinatie van precisie en betrouwbaarheid, ook wel geometrische nauwkeurigheid genoemd.

In hoeverre denkt u vragen te kunnen beantwoorden over de geometrische kwaliteit van de BGT in uw gebied?

Dit zal geen probleem zijn

Ik twijfel, ik wil wel een poging wagen

Ik kan hier weinig over zeggen. (u wordt doorgestuurd naar het volgende onderwerp)

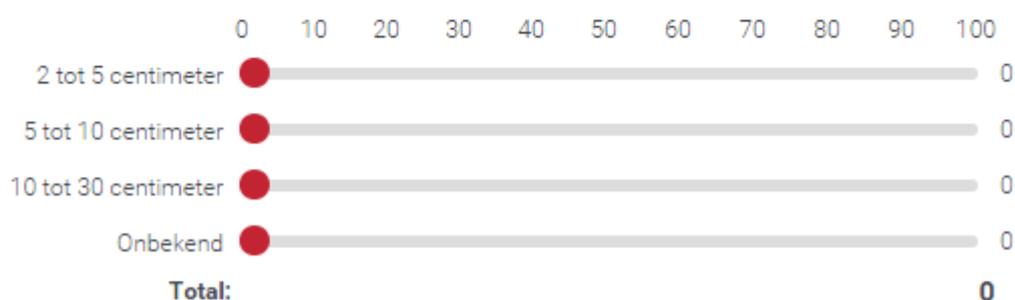
Vorige

Volgende

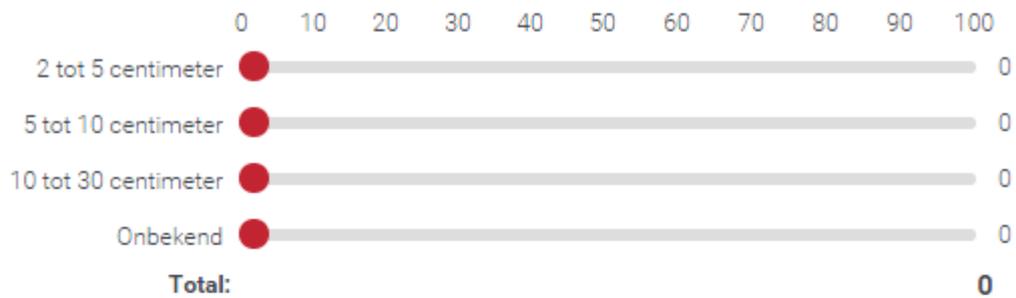
In opdracht van het programmabureau BGT heeft onderzoeksbureau Statistact u informatie gevraagd in hoeverre u aan de vereiste geometrische nauwkeurigheid van het IM-BGT verwacht te voldoen. De resultaten zijn gepubliceerd in 'De stand van de BGT, Monitorrapportage maart 2015'. Deze informatie zal voor dit onderzoek gebruikt worden. De onderstaande vragen gaan hier nog iets dieper op in.

Er kan onderscheid gemaakt worden tussen harde topografie (gebouwen en civiel technische kunstwerken) en zachte topografie (o.a. begrenzingen van wegen en water). Voor het Kadaster is de harde topografie het meest interessant qua afstemming van de kadastrale kaart met de BGT.

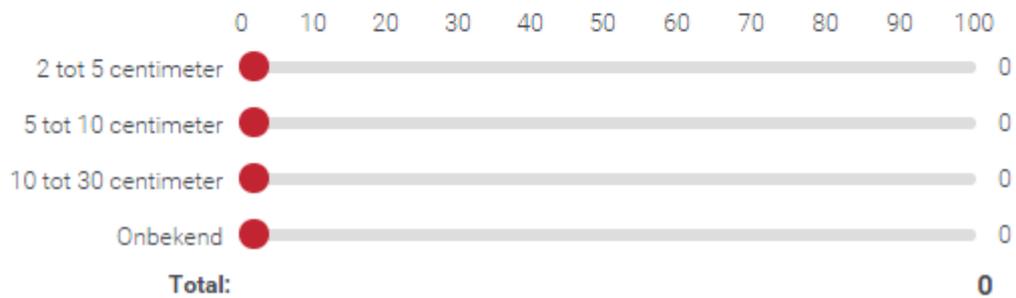
Voor welk percentage van uw areaal voldoet de bebouwing momenteel aan de onderstaande 'geometrische nauwkeurigheid schalen'?



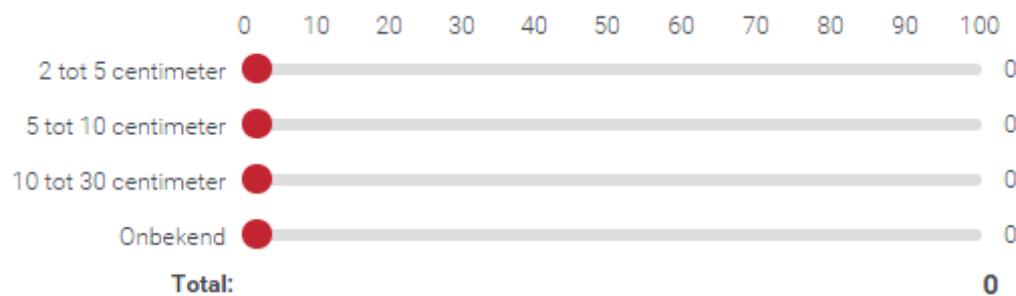
Gezien uw ambitie, voor welk percentage van uw areaal zou de bebouwing aan de onderstaande 'geometrische nauwkeurigheid schalen' moeten voldoen?



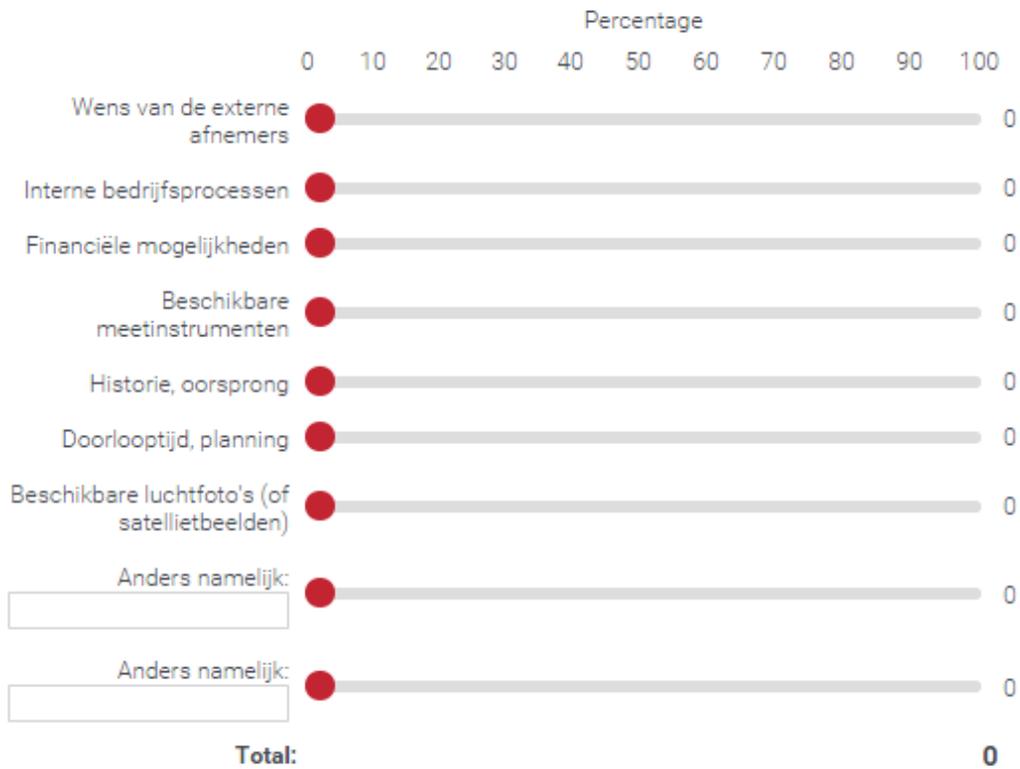
Voor welk percentage van uw areaal voldoen de civiel technische kunstwerken momenteel aan de onderstaande 'geometrische nauwkeurigheid schalen'?



Gezien uw ambitie, voor welk percentage van uw areaal zouden de civiele technische kunstwerken aan de onderstaande 'geometrische nauwkeurigheid schalen' moeten voldoen?



In hoeverre spelen onderstaande factoren mee bij de keuze voor een bepaalde geometrische nauwkeurigheid van de harde topografie?



Zet de onderstaande potentiële afnemers op volgorde wat betreft hun belang bij een BGT met terrestrische nauwkeurigheid (2-5 cm), voor zover u dat kunt inschatten. De afnemer met het hoogste belang geeft u het cijfer 1 enz. U kunt schuiven met de afnemers.

Kadaster

Nutsbedrijven

Afdeling beheer openbare ruimte

Andere afdelingen binnen de organisatie

De burger

Anders namelijk:

Anders namelijk:

Vorige

Volgende

Onderstaande vragen gaan specifiek over samenwerking met het Kadaster.

Het Kadaster is op zoek naar mensen met specifieke gebiedskennis. Zijn er personen binnen uw organisatie die op de hoogte zijn van de kwaliteit van de kadastrale kaart in delen van uw gebied?

Ja, voor het volledige gebied

Ja, voor een gedeelte van het gebied

Nee

Onbekend

Anders, namelijk:

Wat zou het Kadaster u kunnen bieden wat het beheer, de bijhouding en/of de distributie van de BGT vergemakkelijkt?

Bent u geïnteresseerd in nauwere samenwerking op het gebied van de BGT en de kadastrale kaart?

Ja, ik zie dat op de volgende manier voor me:

Nee, omdat:

Ja, echter na de realisatie van de BGT, ik zie dat op de volgende manier voor me:

Zou u deel willen nemen aan een inhoudelijke discussiesessie aangaande samenwerking op het gebied van de kadastrale kaart en de BGT?

Nee

Ja, vul hier het mailadres in waarmee we u kunnen bereiken:

Wat is uw mening over onderstaande stellingen?

	Zeer mee oneens	Mee oneens	Neutraal	Mee eens	Zeer mee eens	Geen mening
De BGT en de kadastrale kaart moeten dezelfde geometrische nauwkeurigheid hebben.	<input type="radio"/>					
De huidige kadastrale kaart is een goed product.	<input type="radio"/>					
De geometrische nauwkeurigheid van de kadastrale kaart moet verhoogd worden.	<input type="radio"/>					
De geometrische nauwkeurigheid van de BGT moet verhoogd worden.	<input type="radio"/>					

Vorige

Volgende

U heeft aangegeven de kadastrale kaart geen goed product te vinden. U zou ons ontzettend helpen als u deze keuze zou willen toelichten. Wees vrij om daar onderstaand tekstvak voor te gebruiken.

Vorige

Volgende

Ruimte voor tips en/of opmerkingen.

Zouden wij contact met u mogen opnemen voor vragen aan de hand van dit onderzoek?

Nee

Ja, vul hier het mailadres in waarmee we u kunnen bereiken:

Wilt u op de hoogte gehouden worden van de resultaten van dit onderzoek?

Nee

Ja, vul hier het mailadres in waarmee we u kunnen bereiken:

Hartelijk dank voor het invullen van de enquête. Voor verdere vragen of opmerkingen kunt u contact opnemen door te bellen of te mailen.

Met vriendelijke groet,

Alexander Boersema

Student Geographic Information, Management and Applications
boersema@gmail.com
06-49924573

Vorige

Volgende

A2: POLL USER NEEDS CADASTRAL MAP

The reactions on this poll are used in section 3.3; the analysis of the responses of users of the cadastral map.

1 Onder welke gebruikersgroep valt u?

Single-responsevraag

- Notariaat
- Vastgoed
- Particulier
- Zakelijk
- Gemeenten
- Waterschappen
- Provincies
- Overige overheidsinstanties
- Bouwnijverheid & Ingenieursbureaus
- Nutsbedrijven
- Anders, namelijk

2 Welk product heeft u afgenomen?

Single-responsevraag

- Uittreksel kadastrale kaart met omgevingskaart
- Uittreksel kadastrale kaart
- Digitale kadastrale kaart

3 Met welke frequentie neemt u de kadastrale kaart af?

Single-responsevraag

- Eenmalig
- 1 keer per week
- 1 keer per maand
- 1 keer per kwartaal
- 1 keer per jaar
- Anders, namelijk

4 Met welk doel heeft u het product afgenomen?

Single-responsevraag

- Voor het aanvragen van vergunningen
- Voor het ontwerpen van kaarten
- Voor analyse doeleinden
- Voor het ontwerpen van (bestemmings)plannen
- Voor de verkoop van grond
- Voor de verkoop van een woning
- Voor de aankoop van een woning
- Voor verkrijgen van een globaal overzicht van het perceel en de omgeving
- Als input voor een geografisch informatie systeem
- Anders, namelijk:

5 Zet onderstaande (potentiële) eigenschappen van de kadastrale kaart op volgorde van het belang dat u er aan hecht. Zet de meest belangrijke eigenschap voor uw werkzaamheden bovenaan en de minst belangrijke eigenschap onderaan.

Rangordevraag

Minimaal aantal vinkjes: 0

Nauwkeurigheid (positionele precisie en betrouwbaarheid)

Actualiteit

Consistentie met topografie

Volledigheid

6 Is voor het door u gekozen/beschreven doel de mate van geometrische nauwkeurigheid van belang?

Single-responsevraag

Onder geometrische nauwkeurigheid verstaat men de mate waarin de opgeslagen coördinaten overeenkomen met de waarden in de werkelijkheid of de geaccepteerde afwijking.

VRAAG 6 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> VOLGENDE VRAAG

vraag 4 is niet beantwoord met 8 (Voor verkrijgen van een globaal overzicht van het perceel en de omgeving)

- Ja
- Nee

7 Welke geometrische nauwkeurigheid is van de kadastrale kaart gewenst voor het doel waarmee u de kaart afneemt? *Single-responsevraag*

Onder geometrische nauwkeurigheid verstaat men de mate waarin de opgeslagen coördinaten overeenkomen met de waarden in de werkelijkheid of de geaccepteerde afwijking.

VRAAG 7 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> **VOLGENDE VRAAG**

vraag 6 is beantwoord met 1 (Ja)

- 2-5 centimeter
- 5-10 centimeter
- 10-20 centimeter
- 20-30 centimeter

8 Wat is uw mening over onderstaande stellingen? *Tabelvraag (single response)*

Onder topografie wordt verstaan, het geheel van alle topografische objecten in een bepaald gebied. Denk aan, bebouwing, straat (namen), bomen en bruggen.

Onder geometrische nauwkeurigheid verstaat men de mate waarin de opgeslagen coördinaten overeenkomen met de waarden in de werkelijkheid of de geaccepteerde afwijking.

	Helemaal mee eens	Mee eens	Neutraal	Mee oneens	Helemaal mee oneens	Geen mening
Bij de kadastrale kaart hoeft geen topografie meegeleverd te worden.	<input type="radio"/>					
De geometrische nauwkeurigheid van de kadastrale kaart moet verhoogd worden.	<input type="radio"/>					
Er mag geen verschil in geometrische nauwkeurigheid zitten tussen de kadastrale kaart en de onderliggende topografische kaart.	<input type="radio"/>					

9 U heeft de stelling: Bij de kadastrale kaart hoeft geen topografie meegeleverd te worden. beantwoord met (helemaal) mee eens of (helemaal) mee oneens, u heeft hieronder de mogelijkheid om uw keuze verder toe te lichten. *Open vraag (groot)*

Het geven van een toelichting is niet verplicht.

VRAAG 9 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> VOLGENDE VRAAG

Minstens één van onderstaande voorwaarden is waar:

- of vraag 8.1 is beantwoord met 1 (Helemaal mee eens) - of vraag 8.1 is beantwoord met 2 (Mee eens) - of vraag 8.1 is beantwoord met 4 (Mee oneens) - of vraag 8.1 is beantwoord met 5 (Helemaal mee oneens)

10 U heeft de stelling: De geometrische nauwkeurigheid van de kadastrale kaart moet verhoogd worden. beantwoord met (helemaal) mee eens of (helemaal) mee oneens, u heeft hieronder de mogelijkheid om uw keuze verder toe te lichten. *Open vraag (groot)*
Het geven van een toelichting is niet verplicht.

VRAAG 10 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> VOLGENDE VRAAG

Minstens één van onderstaande voorwaarden is waar:

- of vraag 8.2 is beantwoord met 1 (Helemaal mee eens) - of vraag 8.2 is beantwoord met 2 (Mee eens) - of vraag 8.2 is beantwoord met 4 (Mee oneens) - of vraag 8.2 is beantwoord met 5 (Helemaal mee oneens)

11 U heeft de stelling: Er mag geen verschil in geometrische nauwkeurigheid zitten tussen de kadastrale kaart en de onderliggende topografie. beantwoord met (helemaal) mee eens of (helemaal) mee oneens, u heeft hieronder de mogelijkheid om uw keuze verder toe te lichten. *Open vraag (groot)*
Het geven van een toelichting is niet verplicht.

VRAAG 11 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> VOLGENDE VRAAG

Minstens één van onderstaande voorwaarden is waar:

- of vraag 8.3 is beantwoord met 1 (Helemaal mee eens) - of vraag 8.3 is beantwoord met 2 (Mee eens) - of vraag 8.3 is beantwoord met 4 (Mee oneens) - of vraag 8.3 is beantwoord met 5 (Helemaal mee oneens)

12 Hoe belangrijk vindt u het dat de onderstaande topografie (semantische informatie) meegeleverd wordt bij de kadastrale kaart? *Tabelvraag (single response)*
Semantische informatie: dit is informatie om de kaart beter leesbaar en bruikbaar

te maken. Het gaat dan om straatnamen, huisnummers en andere relevante namen

	Zeer onbelangrijk	Onbelangrijk	Neutraal	Belangrijk	Heel belangrijk	Geen mening
Gebouwen	<input type="radio"/>					
Huisnummers	<input type="radio"/>					
Straatnamen	<input type="radio"/>					

13 In welke frequentie (percentage) en met welke hoeveelheid (aantal percelen) neemt u de kadastrale kaart af? *Tabelvraag (single response)*

Met behulp van de antwoorden op deze vraag kunnen wij ons systeem zo aanpassen dat deze beter aansluit op de wensen van de afnemer. Het geeft ons meer inzicht in de volumes en het soort afnamen.

(de beantwoording van deze vraag is optioneel, wanneer de vraagstelling u niet helemaal duidelijk is, sla deze vraag dan gerust over)

	Nooit	1-30% van de afnames	30-60% van de afnames	60-99% van de afnames	Elke afname
1 perceel	<input type="radio"/>				
2-10 percelen	<input type="radio"/>				
10-25 percelen	<input type="radio"/>				
> 25 percelen	<input type="radio"/>				

14 Ruimte voor overige tips en/of opmerkingen: *Open vraag (groot)*

15 Wanneer wij nog vragen hebben aan de hand van de enquête mogen wij u dan benaderen? *Single-responsevraag*

Ja, u kunt mij bereiken op het volgende mailadres:

Nee