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Geographical Information Management and Applications

BAG & BGT: Spatial Key Registers

Compatibility and municipal use in Zwolle

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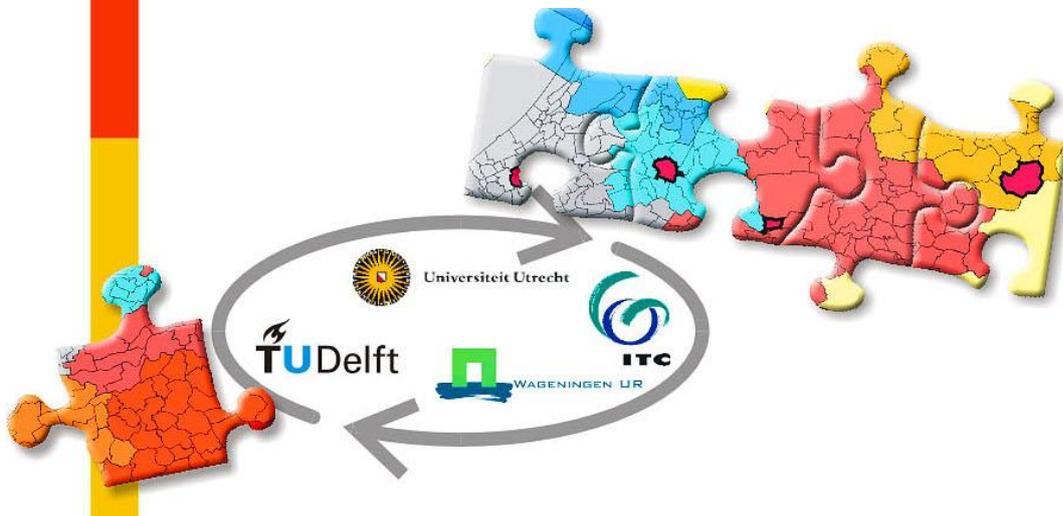
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Summary

This thesis seeks to explore the impacts of the introduction of two key registers on the spatial data administration of the municipality of Zwolle. These key registers will authentically store building and address data (BAG) and large-scale topographic data (BGT). Using mainly policy documents and interviews, the degree of compatibility between the BAG and BGT key registers is examined, as well as several possibilities for altering the spatial data administration of municipalities, and Zwolle in particular.

The analysis of the degree of compatibility between the BAG and BGT key registers focuses on the building geometry that is present in both registers in a different form. While this double presence is contrary to the goals of the network of key registers, and the NUP e-government program it belongs to, it is in practice not a major problem for the implementation of BAG and BGT, since numerous organizational and technical options exist that can be used by municipalities to mitigate the problems.

The introduction of the BAG and BGT key registers also provides an opportunity to evaluate the municipal spatial data administration at Zwolle. Potential changes could include the integration of municipal BOR and BGT data, data collection methods, centralization of municipal data collection and maintenance, and the division of BGT sourceholder data.

Samenvatting

Deze scriptie heeft als doel het onderzoeken van de invloed van de introductie van twee basisregistraties op het beheer van ruimtelijke data bij de gemeente Zwolle. Deze basisregistraties zullen respectievelijk data over adressen en gebouwen (BAG) en grootschalige topografie (BGT) bevatten. Door middel van beleidsdocumenten en interviews wordt de mate van samenhang tussen de basisregistraties BAG en BGT onderzocht, evenals enkele mogelijkheden om het beheer van ruimtelijke data te veranderen voor gemeenten in het algemeen en Zwolle in het bijzonder.

De analyse aangaande de mate van samenhang tussen de basisregistraties BAG en BGT focust zich op de pandgeometrie die in beide basisregistraties in een andere vorm aanwezig is. Hoewel deze dubbele aanwezigheid strijdig is met de doelstellingen van het stelsel van basisregistraties en het e-overheidsprogramma NUP waar het toe behoort, blijkt het in de praktijk geen groot probleem voor de implementatie van BAG en BGT, omdat er diverse organisatorische en technische mogelijkheden zijn die gemeenten kunnen gebruiken om de problemen te ondervangen.

De introductie van de basisregistraties BAG en BGT biedt ook een kans om het gemeentelijk beheer van ruimtelijke data te evalueren. Mogelijke veranderingen kunnen zijn de integratie van gemeentelijke BOR-data (Beheer Openbare Ruimte) met de BGT, wijzigingen in methoden van data-inwinning, centralisatie van de inwinning en het beheer van gemeentelijke data, en de verdeling van het bronhouderschap van de BGT.

Preface

When I first started thinking about this thesis in September 2009, I only had a vague idea what a key register was. I had heard the term a few times, mostly in connection to an UML schematic of a key register that we had studied during one of the modules for GIMA: Geographic Information Management and Applications, the Master program for which this thesis is one of the final requirements. When I approached Peter van Capelleveen about the possibility of writing my thesis at the municipality of Zwolle, he suggested this topic to me. The first few months I spent digging through policy documents and other literature, talking to various people, revising my research proposal several times, and starting to get an actual idea of what my thesis subject really was about. This is, I believe, a time-honored way of starting any research on any subject. Eventually, this all led to understanding and insights into key registers and municipal spatial data administration, which can be found in this thesis.

I'd like to thank everyone who assisted me with this thesis, especially my GIMA and Zwolle supervisors, Jaap Besemer, Bastiaan van Loenen, Peter van Capelleveen, and Christiaan Wolters, who contributed many useful suggestions about the academic and municipal content of this thesis. Thanks are also in order for the various people who agreed to be interviewed by me, as these interviews proved very interesting and helpful. Lastly, thanks are in order to my colleagues at the municipality for supporting me during the writing of this thesis.

Table of Contents

1. Introduction.....	8
2. Methodology.....	10
2.1. Scope.....	13
3. What Are Key Registers?	15
3.1 Key registers.....	15
3.2. BAG	19
3.3. BGT.....	23
3.4. WOZ	26
4. Why Key Registers?	29
4.1 e-Government.....	30
4.2 SDI	31
4.3 EU Policy	34
5. Compatibility of BAG, BGT and WOZ registers.....	36
6. Organization of spatial data at Zwolle.....	41
6.1. BOR and BGT integration	41
6.2. Data collection: aerial photography and terrestrial surveying.....	43
6.3. BGT sourceholders.....	47
6.4. Central data management.....	50
7. Conclusions.....	53
References.....	58
Appendix A: Answers to municipal questionnaire	63

List of Tables and Figures

Table 1. List of all twelve key registers..... 17

Figure 1. Relations between the key registers. 21

Figure 2. UML-schematic of the contents of the BAG register.. 22

Figure 3. Hierarchy and the process- and product-based approaches to SDI..... 33

Figure 4. Sourceholders using aerial photography to maintain and update spatial databases..... 45

Figure 5. Contents of mutations processed using aerial photography 45

1. Introduction

During much of the twentieth century, computers were either nonexistent, or were massive machines, used only by a handful of the largest public and private organizations for very specific tasks. From there, computers slowly evolved to where they are today, and it is only during the last thirty years that they have become commonplace. During this time, the role of the computer has evolved towards a multipurpose tool (Bemelmans, 1998). The vast majority of professional work has been affected by the introduction of computers, including cartography. Computerized databases today allow for a vastly greater amount of functions that can be easily performed on spatial data. The Dutch national government first recognized this shift in the last decade of the previous millennium, and began developing policy to optimize government processes with regard to the possibilities offered by new technologies like the increasing use of computers and the rise of the internet (Duivenbode & De Vries, 2003). One method of optimizing government processes is ensuring that the entire public sector in the Netherlands use the same datasets, stored in central databases (e-Overheid, 2008).

These central databases are referred to as *key registers*, and two of these registers are the main subject of this thesis: BAG (*Basisregistratie Adressen en Gebouwen*), which stored address and building data; and BGT (*Basisregistratie Grootchalige Topografie*), which stores topographic data. Both these registers contain spatial information crucial to the functioning of Dutch governments, and both have the ability to cause significant changes to municipal spatial data administration. BAG is currently in the early stage of implementation, and about ten percent of all Dutch municipalities are currently connected to the central database, while BGT is still in its design phase. In addition to BAG and BGT, some attention will also be given to the WOZ key register (*Waardering Onroerende Zaken*), containing real estate valuation data. This register is included because it also somewhat spatial in nature, and because, like BAG and BGT, also has a strong municipal focus.

The implementation of these registers will bring changes to their users, all of them public organizations, and municipalities often play a central role. However, the exact nature of the changes that the key registers will bring depends on several issues. These include the precise contents of the registers, but also the compatibility of the key registers. This includes compatibility between themselves and other key registers, as well as compatibility with the organization in which they are implemented. This thesis seeks to explore these issues: are the key registers quite up to the tasks for

which they are designed, and what changes will their implementation cause? Focusing on the municipality of Zwolle, an analysis was made to explore the potential problems and opportunities that could result from implementation of the registers at the municipality of Zwolle, as far as these problems or opportunities are caused by the contents of the registers, or by some other factor of their design.

2. Methodology

This chapter discusses the methodology of this thesis. The main objectives of this research are to explore the compatibility of the key registers BAG and BGT, as well as exploring the effects of their implementation on the spatial data administration at the municipality of Zwolle. In order to accomplish these goals, the following research questions were defined:

- To what extent are the BAG and BGT key registers compatible with their intended usage, and to what extent does this compatibility influence the spatial data administration of the municipality of Zwolle?
 - What are key registers?
 - Why are key registers being created?
 - How is the spatial data administration at the municipality of Zwolle currently organized?
 - To what extent are the contents of the BAG and BGT registers compatible with each other?
 - What changes will the introduction of the BAG and BGT registers bring to the spatial data administration of the municipality of Zwolle?

The first chapter of this thesis seeks to answer the first subquestion. This background chapter will explain what the function of key registers is, as well as provide some technical and organizational details. The BAG and BGT registers, which are the focus of this thesis, will be explored in more detail, including the objects and attributes that form the content of these registers. The WOZ register will also be briefly explored here, since this register has important links with the BAG register. Furthermore, this chapter also contains an overview of the twelve key registers that either currently exist or that will be created, as well as information regarding the links between the various registers, and specifically the links that BAG and BGT have with the other registers, as well as with each other. This information was found in literature, mainly consisting of government websites and policy documents on the subject of either key registers in general, or the BAG and BGT registers specifically.

The second chapter explains the reasons why the network of key registers was created. The second subquestion is answered here, and, like the first chapter, will also provide background information. In this chapter, the focus will be the decision of the Dutch national government to create the network

of key registers. This subject can be split into three parts. The first part contains a discussion of the links between the network of key registers and the concept of e-government. The concept of e-government embodies digital public services and use of IT in government processes, and as such applies to the concept of key registers. An example of a relevant program that will be discussed in this section is the NUP program¹ (e-Overheid, 2008), which coordinates various efforts by the Dutch government to increase the quality of its digital services. In turn, a short explanation will be included as to the reasons why the Dutch government thought it necessary to improve these services (Duivenboden & de Vries, 2004). A more general background on the status of e-government in the Netherlands will also feature here (OECD, 2007). This chapter will also contain a short analysis on the concept of Spatial Data Infrastructure in relation to key registers. A comparison will be made to explore the degree to which key registers can be said to be an SDI, both in theory (Rajabifard et al., 2008; De Man, 2006) and in practice (Jacoby et al., 2002). Finally, information on the links between the network of key registers and the European policies on SDI and related issues will also be provided. The most prominent example of this is the INSPIRE directive, which seeks to further the development of SDI's in EU member states (European Community, 2007).

Thirdly, there is the question of the current organization of spatial data at the municipality of Zwolle. This will be an empirical part of this thesis: this section will seek to determine what departments at the municipality currently use such data as will likely be stored in the BAG and BGT registers, as well as how this data is created and used. Important questions to be answered are who uses what data (for example, address data), as well as how they use it: whether they are the source of certain data, whether they maintain or edit it, or if they only use it, perhaps for reference. These questions will be answered for the main components of the BAG and BGT registers. In addition to that, the definitions of the main objects of the BAG and BGT registers will be explored, in an attempt to find potential conflicts between users. For example, are there multiple users within the municipality of Zwolle that use road data, and what are their definitions of the object 'road'? Is it possible for them to use a different definition? By answering these questions, an overview of potential problems in BAG and BGT implementation can be made. These problems can either stand on their own, they can be specific to the municipality of Zwolle, or they could point to problems inherent in the key registers: flaws in the design of the registers which causes problems in their implementation. The method of finding answers to the above questions will primarily be interviews, supported by policy documents where possible.

¹ *Nationaal Uitvoeringsprogramma Dienstverlening en e-Overheid, or 'National Implementation Program for Services and e-Government'.*

Moving away from the contents of, and policy behind, the network of key registers, the fourth chapter seeks to explore the degree to which the BAG and BGT registers are compatible with each other, with other spatial key registers, and with the network of key registers as a whole. Since the BAG and BGT registers are both geometric at their core, some degree of compatibility between the two can be expected, as well as some level of coordination on the policy level (Programmabureau Stroomlijning Basisgegevens, 2002; e-Overheid, 2008). In addition to policy documents about the stated goals for the key registers, this chapter, as well as the next, will also feature information from interviews with various persons: Ms. Ellenkamp, a civil servant from the Ministry of VROM, which is responsible for designing and overseeing the BAG and BGT registers; Mr. Piersma and Mr. Te Velthuis, both responsible for maintaining databases relating to the public space (BOR) at the municipality of Zwolle; Mr. Ytsma, Zwolle's BAG coordinator; Mr. Keppel, Zwolle's BAG project leader, Mr. Van Dijk, Zwolle's WOZ coordinator; Mr. Van Der Lely, senior consultant at Grontmij for spatial database software, used at Zwolle; and Mr. Krijtenburg, who is a geo-information specialist at the municipality of Amsterdam, as well as a member of the BGT project group responsible for the content and definitions of the register.

The fifth and final subquestion combines some of the information from the previous questions. Here, some of the effects will be discussed that the key registers may have on the spatial data administration of the municipality of Zwolle. These effects are based on a combination of interviews with municipal and external personnel, as well as information concerning key register contents and policies, which is covered in the earlier chapters. Some of the subjects include the use of top-down geometry in the BAG register, consequences of object-oriented geometry in both BAG and BGT, as well as a brief discussion of more centralized organization for the creation and maintenance of spatial data, both at Zwolle and in a wider context.

In addition to the specific interviews mentioned above, attempts have also been made to verify the findings in this thesis against the experiences at other municipalities. To accomplish this, a six-page summary of some of the preliminary findings of this thesis was sent to relevant persons at twelve Dutch municipalities, mostly senior specialists or managers in geo-information or general data management. This summary was accomplished by seven questions, touching on various subjects like data collection methods, centralized data administration, integration of spatial datasets, and more. The municipalities in question included some of the largest cities in the Netherlands, as well as several rural municipalities. However, five of the eight returned questionnaires were returned from municipalities with 100,000 residents or more, the other three coming from smaller municipalities.

For this reason, caution should be exercised when interpreting these results, since the municipalities chosen are not a random sample of all Dutch municipalities, nor is the number of returned questionnaires large enough for effective quantitative analysis. The municipalities' responses are only used to verify whether there is some degree of wider support for some of the findings of this thesis at Zwolle.

2.1. Scope

In general, the goal of this research is to explore the consequences of the implementation of the BAG and BGT key registers at the municipality of Zwolle. To this end, this thesis contains an introduction to the concept of key registers, the contents of the BAG and BGT key registers, as well as their internal consistency and compatibility, policy reasons behind their implementation, and information concerning the organization of the spatial data administration at the municipality of Zwolle. This thesis also includes a short discussion on the European Union's INSPIRE directive, since it is aimed at stimulating the development and use of Spatial Data Infrastructures (SDI) that includes projects like the key registers. Another part of the thesis discusses the concept of Spatial Data Infrastructure in greater detail, specifically the extent to which the key registers can be considered SDI.

Exploring consequences of the implementation of key register should not be confused with implementation problems. The former is what this thesis seeks to explore: problems stemming from the contents and definitions of the BAG and BGT registers, relating to the spatial data administration of the municipality of Zwolle. The latter, on the other hand, covers problems with the process of implementation, and is largely a project management issue that falls outside the scope of this thesis.

The theoretical parts mentioned above mostly deal with fairly clear and well-defined subjects: what are key registers, and why are they being implemented? However, there are several limitations to the empirical side of this research. First of all, there is the fact that the thesis will be focused on the municipality of Zwolle. Research at other municipalities could show different results. While care will be taken to verify the findings at Zwolle with key personnel at other municipalities, some caution must still be exercised when directly applying the findings from this thesis to any other municipality.

Another limitation is the number of interviews that will be held. As described previously, these interviews are used to determine what conflicts certain users and managers at Zwolle (as well as

several people outside the municipality) have experienced, or expect to experience, when dealing with the BAG and BGT registers. Because of resource constraints, it is not feasible to interview every single person working with BAG and BGT information at Zwolle. Therefore, interviews were limited to a set of people that hopefully represents the diversity of users at the municipality that work with BAG and BGT information, as well as a small number of experts outside the municipality. Where possible, certain questions were standardized across all interviews, but the interviewed persons also hold diverse positions, both inside and outside the municipality of Zwolle, making highly standardized interviews not possible. Instead, the interviews were largely open, with several main questions serving mostly as guidelines.

3. What Are Key Registers?

This chapter seeks to provide background and context concerning the key registers in general, and the BAG and BGT registers specifically. First, more detail will be provided concerning the concept of key registers; what they are, how they should function, and how they are different from earlier (spatial) databases.

3.1 Key registers

As mentioned before, key registers are databases that hold information for which they are the only valid and approved source for government use; such information is called *authentic* information. The data in such a key register is the only source for that data that governments in the Netherlands are permitted to use. They will no longer be allowed to collect any data that already exists in a key register. For example, the GBA key register will hold municipal records of residency, age, marital status, and other personal information. Any public institution needing such records will have to use those records present in the GBA key register, and are not allowed to obtain this data from a different source. Similarly, the key registers operate on the principle of '*collect once, use many times*'. Once a key register is operational, governments and other public institutions are no longer allowed to collect that data separately, instead they will have to use the data already present in the register. Concerning the maintenance of the registers, two separate issues need to be distinguished. First, most key registers have a single public institution that is responsible for the database maintenance, its storage, and the distribution of data to the users upon request. In the case of the Key register for Addresses and Buildings (BAG), this institution is the Central Facility BAG (*Landelijke Voorziening BAG*), or LV BAG. The actual data in the registers, however, is supplied and updated by so-called sourceholders (*bronhouders*). These sourceholders are usually those institutions which have traditionally maintained similar databases.

In total, there are twelve key registers currently envisioned. However, since this is already more than the six registers initially envisioned in a 2002 policy document (Programmabureau Stroomlijning Basisgegevens, 2002), it is not unthinkable that more registers might be added in the future.

Currently, these twelve key registers are in various stages of completion. Some are still in the design phase, others are nearly complete and almost operational. Table 1 below lists all twelve key registers:

Table 1. List of all twelve key registers. Source: <http://www.routeplannerbasisregistraties.com/>

Dutch Name:	English Name:	Abbreviation:	Type of Data:	Responsible Institution(s):	Current status:
Basisregistratie Adressen en Gebouwen ²	Key Register for Addresses and Buildings	BAG	Administrative: contains addresses, premises, their size and occupancy status, relevant dates	Ministry of Housing, Spatial Planning, and the Environment (VROM)	Implementation phase
Basisregistratie Lonen, Arbeidsverhoudingen en Uitkeringen	Key Register for Wages, Labor Relations and Benefits	BLAU	Administrative, socio-economic.	Ministry of Social Affairs and Employment	Design phase
Basisregistratie Grootschalige Topografie	Key Register for Large-Scale Topography	BGT	Topographic: infrastructure, buildings. 1:5000 and larger.	Ministry of Housing, Spatial Planning, and the Environment (VROM)	Design phase
Basisregistratie Inkomsten	Key Register for Income	BRI	Financial: tax records	Ministry of Finance; Tax and Customs Administration	Partially active
Basisregistratie Kadaster	Key Register for the Cadastre	BRK	Administrative, legal, geographic. Contains ownership and usage data for parcels and buildings.	Ministry of Housing, Spatial Planning, and the Environment (VROM); the Cadastre	Active
Basisregistratie Ondergrond	Key Register for the Subsurface	BRO	Geographic: soil information	Ministry of Housing, Spatial Planning, and the Environment (VROM); TNO	Design phase

² The BAG actually consists of two separate key registers: the Key Register for Addresses and the Key Register for Buildings. However, the two are intricately linked and are usually considered to be a single register. This thesis will also treat the BAG as a single key register.

Basisregistratie Topografie	Key Register for BRT	Topographic: 1:10000 maps	Ministry of Housing, Spatial Planning, and the Environment (VROM)	Partially active	
Basisregistratie Voertuigen	Key Register for BRV	Vehicle licensing information	Rijksdienst voor Wegverkeer (RDW).	Active	
Gemeentelijke Basisadministratie	Municipal Basic Register	Administrative: personal records	Ministry of the Interior and Kingdom Relations (BZK); Agentschap BPR	Active	
Handelsregister	Trade Register	-	Administrative: contains companies, their activities and location	Ministry of Economic Affairs; Chamber of Commerce	Active; transitional period
Registratie Ingezetenen	Niet-Register for Non-Inhabitants	RNI	Administrative: natural persons in foreign countries with a relation to the Netherlands	Ministry of the Interior and Kingdom Relations (BZK); Stichting ICTU	Design phase
Basisregistratie Onroerende Zaken	Waarde Key Register for Real Estate Valuation	WOZ	Administrative, financial. Contains property tax records and valuations.	Ministry of Finance; De Waarderingskamer	Active; transitional period

As *Figure 1* shows, the key registers cover a variety of topics, containing not just spatial data but financial and population records as well. Any register can be accessed by those institutions that have the proper authorization, as regulated by law. For example, utilities companies will be able to request information from the BRO register, in order to check whether a planned cable or pipeline will interfere with existing ones.

A key feature of the design of the BAG and BGT registers is that they integrate administrative and geometric data – two domains that existed separately in the past. Such object-oriented spatial databases make it possible to store information that is directly related to objects in the real world, by relating it to representative objects in the databases. A house is represented by a 2D surface, for example, with coordinates that correspond to its location in the real world. That geometric surface has then various attributes directly linked to it. Usually, such attributes include at least a unique ID number and some sort of classification ('building', 'house' or 'structure', for example), but more attributes can be easily added by users. These properties make object-oriented databases very suitable for both analysis and visualization. In the case of the BAG and BGT registers, geometric objects also provide the possibility to generalize data to a smaller scale (VROM, 2009a). In general, the use of object-oriented spatial databases leads to a shift away from using administrative data as the 'main' data, instead using geographic data as a sort of 'access point' to information concerning an object. By linking the various spatial and non-spatial databases, it basically becomes possible to access many different types of data through a single map query.

3.2. BAG

The BAG (*Basisregistratie Adressen & Gebouwen*, or *Key Register for Addresses & Buildings*) will ultimately contain data on all buildings and addresses in the Netherlands. Both originate from the municipal level: municipalities are the sourceholders of all BAG data, and they are the institutions responsible for creating and maintaining addresses. Thus, the BAG contains all addresses within the municipality that the municipal government considers valid. This includes street names and house numbers³. The second main piece of data in the BAG register consists of all buildings within each municipality. These buildings can contain one or more occupancy units (*verblijfsobjecten*). Every

³ Postcodes are not maintained by any government, but rather by TNT, formerly the Dutch national postal service PTT.

occupancy unit has one address (a 1:1 relation between the two exists), as well as a relation to the building it is located in. This relation can be one-on-one, meaning a building contains only one occupancy unit, or it can be many-to-one, where a building contains multiple occupancy units. For example, a high-rise residential *building* can contain many *occupancy units* (apartments), each with their own *address*. A building can also contain zero occupancy units, for example garages or warehouses. Like the building geometry, several additional pieces of data are also included in the BAG specifications for occupancy units, including unit size, construction date, status, and several others. All source documents pertaining to administrative or geometric changes to a building must also be stored in the BAG register⁴.

Like all key registers, the BAG register has links to the other key registers (see **Figure 1**). For example, the municipalities' real estate tax systems (WOZ; see below), itself a key register, will derive addresses from the BAG database. WOZ objects are also linked to BAG objects where possible. Note, however, that this link is not direct: a single WOZ object can contain one or more buildings, as well as the land they are located on. In order to link this WOZ-object to BAG, the WOZ-object is divided into WOZ-object parts⁵. Those parts describing a building are linked to the same building in BAG, and those parts describing a tract of land are linked to the Cadastral register (BRK).

Secondly, the BAG database references the municipal personal records database (GBA) key register. It provides valid addresses to the GBA register, which records, among other things, a resident's home address⁶. Thirdly, the BAG register has links with the two topographic key registers, BGT and BRT, which store large-scale and small-scale topography, respectively. BAG building geometry might ultimately be derived from the BGT register, since it is supposed to be the main source of authentic topographic data. However, at least for the time being, building geometry will be stored in the BAG register, until the BGT register is complete.

⁴ Starting from July 1st, 2009

⁵ WOZ-deelobjecten

⁶ However, a resident can also provide a non-BAG address to the GBA register. While any address not in the BAG register does not legally exist, municipalities are legally required to accept addresses given them by residents. However, the BAG register will be notified of this, and the municipality will then investigate if the address should be added to the BAG, or if the resident provided an invalid address.

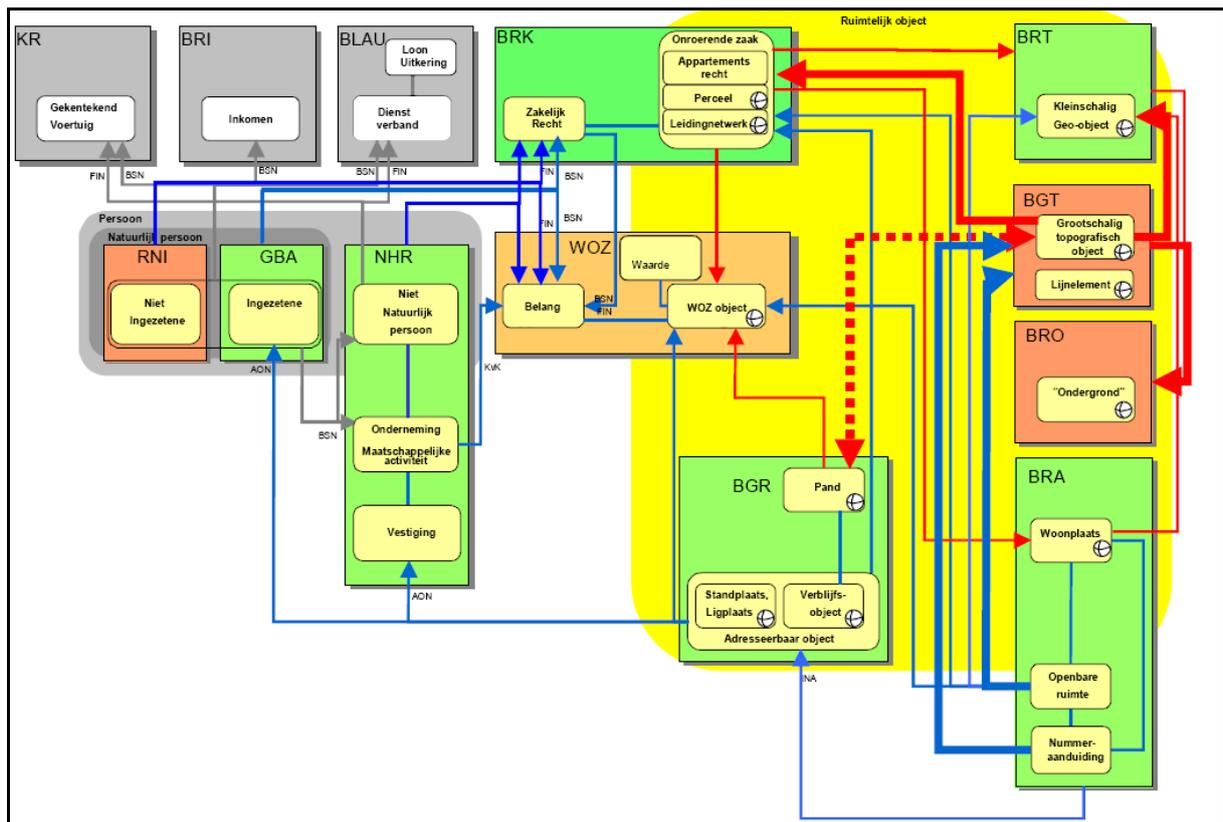


Figure 1. Relations between the key registers. Source: Ministry of VROM, 2009a

The detailed contents of the BAG key register are described in a document by the Ministry of VROM (2009c). A summary of its contents, both geometric and administrative, is given here. The main objects are listed, as well as major attributes of each object⁷. First, however, it is advisable to view **Figure 2**, which provides a visual overview of the contents of the BAG register, as well as the relations between the various objects.

⁷ For example, most objects contain attributes for the start and end date for that object, current status, an ID number, and several other attributes that do not directly relate to the content of the object.

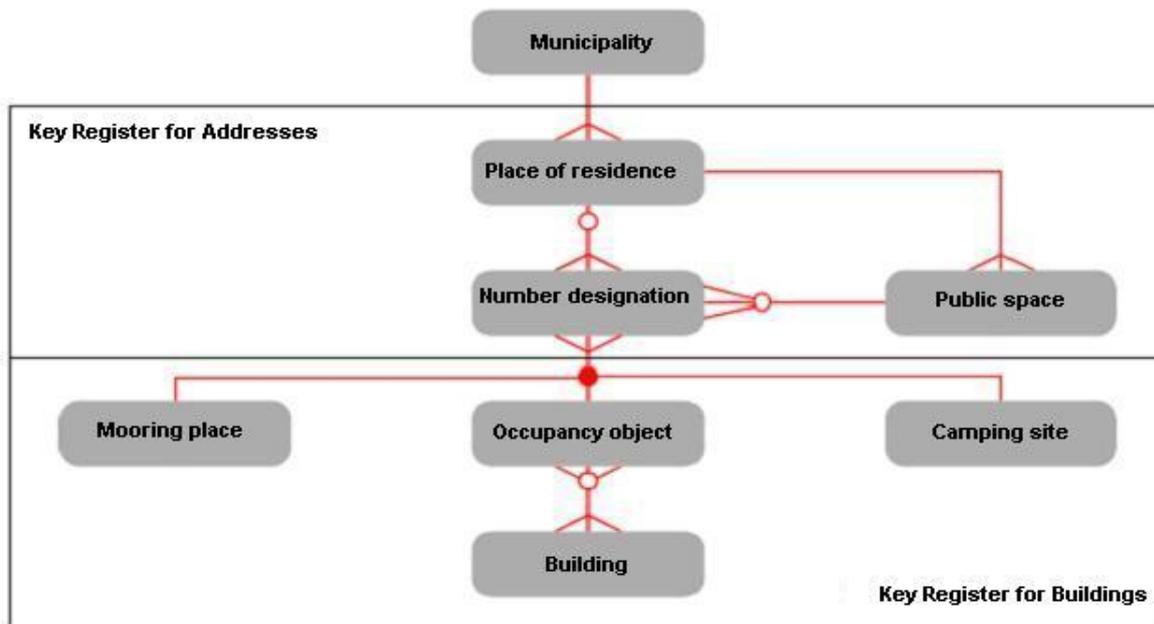


Figure 2. UML-schematic of the contents of the BAG register. Source: Municipality of Amsterdam, 2006. Translation by author.

- Place of residency (woonplaats): a named place (village, town, city) within a municipality. These are designated by the municipal government and each covers a certain part within one municipality. A central list of all places of residency in the Netherlands is thus contained in the BAG register. Attributes:
 - Name
 - Geometry (surface)
- Public space (openbare ruimte): designated as such by a municipal government. Can be any outdoor space that has been given a name by the local municipal government, and is wholly contained within a single place of residency. This covers roads, water, railway lines and certain designated landscape areas.
 - Name
 - Type
- Number designation (nummeraanduiding): A designation by the municipal government for any occupancy object, camping site, or mooring place.
 - Number (including additions)
 - Postcode
- Occupancy object (verblijfsobject): An occupancy object is defined as the smallest useable unit within one or more buildings, suitable for either residential, commercial, or recreational purposes, that is accessible from a public road, a premise or a communal thoroughfare, that

is lockable, that is functionally independent, and that can be the subject of legal acts of property law.

- Designation of main- and subaddresses
- Geometry (point)
- Usage goal
- Surface area
- Status
- Mooring place (ligplaats): a site in the water, possibly including a (part of a) terrain on the shore, that is designated as such by the municipal government, and is designated for permanently mooring a vessel suited for residential, commercial or recreational purposes.
 - Designation of main- and subaddresses
 - Geometry
- Camping site (standplaats): a terrain designated as such by the municipal government, for the purpose of permanently placing a unit suitable for residential, commercial or recreational purposes, that is not directly and not durably connected to the earth.
 - Designation of main- and subaddresses
 - Geometry
- Building (pand): a building is the smallest unit, at completion, that is functionally and architecturally-constructively independent, that is directly and durably connected to the earth, and that is accessible and lockable.
 - Geometry
 - Date of construction
 - Status

3.3. BGT

The goal of the BGT (*Basisregistratie Grootchalige Topografie* or *Key Register for Large-Scale Topography*) is to ensure that the entire public sector in the Netherlands uses the same topographic data set (Ministry of VROM, 2009a). To accomplish this, the BGT will contain a single, object-based topographical database that covers the entire Netherlands. This full coverage is achieved by having a multitude of sourceholders who provide the data, including not only the various levels of government (national, provincial, water boards, and municipalities), but also some private parties like utility providers, who provide datasets covering their own networks of power lines, cell phone

towers, railroad tracks, etc. The BGT differs from the BAG on this point, since the BAG contains only municipal data.

As mentioned above, the BGT register contains topographical data, representing objects that exist in physical space. The BGT will contain all buildings, roads, railroads, rivers, lakes and canals, as well as other landscape elements like forests and most other artificial structures. As the name suggests, the BGT is aimed at displaying topography on a large spatial scale, meaning between 1:500 and 1:5000. The BGT key register will replace the GBKN base map⁸, currently the standard map for large-scale topography. Besides these basic features of the BGT register, most details still need to be worked out in the actual design phase, which started in the third quarter of 2009, and is scheduled to end in the final quarter of 2010.

The BGT, too, will have links to the other key registers. Again, **Figure 1** shows these links. For the BGT, the major links are with BAG, as described above, as well as the links with the BRT, containing small-scale topography (1:10000+). Another link exists with the BRO. This register, as explained previously, is meant to provide a comprehensive database of sub-surface infrastructure. The final major link from the BGT is with the BRK, the cadastral databases that contain real estate ownership information; building geometry will be derived from the BGT register.

A detailed list of the contents of the BGT is given below, similarly to the list of BAG objects given earlier. Note, however, that as of the moment of writing, the design of the BGT is not final, and its content is subject to change. The list below is derived from a concept version of the IMGeo model description document (Geonovum, 2007, 2008), updated to show which elements might be included in the BGT register, which is supposed to be based on the IMGeo model (Ministry of VROM, 2009a). At the moment of writing this thesis, however, there is still much discussion as to which elements should be BGT content, and which elements should not. There is no definite answer either way, whether the BGT will contain a minimum of defined objects, thereby giving municipalities a large amount of freedom to define additional content (*plusinformatie*) themselves, or whether a more complex BGT will be created, so that the register can support a larger amount of public tasks. A third possibility might be that, while mandatory content is kept to a minimum, many additional objects are strictly defined, yet municipalities will be free to decide for themselves if they want to include these objects.

⁸ GBKN: Grootchalige BasisKaart Nederland – Large-scale Base Map Netherlands.

Below each object type are its attributes. However, note that all objects also contain a unique BGT identifier in addition to the attributes already listed here:

- Road segment (wegdeel): Smallest functionally independent part of a road with consistent and homogenous properties and relations for road traffic and grounded air traffic.
 - Relative height (relative to certain other BGT elements' relative heights)
 - Element type (for example, a sidewalk, parking space, or bicycle path). *Optional*
 - Surface type
 - Geometry (surface)
- Railway segment (spoorbaandeeel): Smallest functionally independent part of a railway with consistent and homogenous properties and relations within the railway network.
 - Relative height (relative to certain other BGT elements' relative heights)
 - Element type. *Optional*
 - Geometry (surface)
- Water segment (waterdeel): Smallest functionally independent part of a body of water with consistent and homogenous properties and relations within the Water class.
 - Relative height (relative to certain other BGT elements' relative heights)
 - Element type. *Optional*
 - Geometry (surface)
- Terrain segment (terreindeel): Smallest functionally independent part of a terrain with consistent and homogenous properties and relations within the Terrain class.
 - Relative height (relative to certain other BGT elements' relative heights)
 - Surface material
 - Geometry (surface)
- Artificial construct (kunstwerk): Engineering object for the infrastructure for roads, water, railways, waterworks and/or pipelines, and not meant for permanent human occupation.
 - Construct type
 - Geometry (line or surface)
 - GeometryTopDown (line or surface) *Optional*
- Artificial construct segment (kunstwerkdeel): Part of an engineering object for the infrastructure for roads, water, railways, waterworks and/or pipelines.
 - Relative height (relative to other BGT elements' relative heights)
- Organizational element (inrichtingselement): Spatial object for detailing or arranging of any miscellaneous named spatial objects, or another organizational element.

- Relative height (relative to other BGT elements' relative heights)
- Mast: Tall support construction.
 - Geometry (point, line, surface)
 - Mast type. *Optional*
- Miscellaneous construction (overig bouwwerk): Durable construction, connected to the earth, that is not covered by the definitions of a building or artificial construction.
 - Geometry (surface)
 - Miscellaneous construction type. *Optional*
- Divider (scheiding): A construction separating two objects or spaces from each other.
 - Geometry (line or surface)
 - Divider type. *Optional*
- Rail: Two steel bars, separated by a fixed distance, on which trains, trams, metros or cranes can drive.
 - Geometry (line)
 - Rail type. *Optional*
- Street furniture (straatmeubilair): A spatial object for furnishing public space for which the municipality is responsible. Note that only speed bumps are sometimes valid objects for this class; all other possible types of street furniture objects are not valid BGT content.
 - Geometry (point, line, surface)
 - Street furniture type. *Optional*
- Building (pand): a building is the smallest unit, at completion, that is functionally and architecturally-constructively independent, that is directly and durably connected to the earth.
 - Relative height (relative to other BGT elements' relative heights)
 - Geometry ground level (surface)
 - Geometry top down (surface)
 - BAG ID number (directly linked to the BAG register).

3.4. WOZ

Like all Dutch municipalities, Zwolle also levies property taxes on any land and buildings owned by its citizens and companies. This department is called *Waardering Onroerende Zaken (WOZ)*, or *Valuation of Real Estate*. It is the WOZ department's job to value these properties correctly, in order to base

the amount of taxes owed off these valuations. The WOZ valuation data are also shared with the national tax register and the water boards, who use the data to collect water and pollution fees and taxes, and with the CBS, the Dutch national statistical bureau (Waarderingskamer, 2009a). Note, however, that the abbreviation WOZ, without any further specification, can have three different meanings:

- it can refer to the law that organizes and defines real estate taxation in the Netherlands
- it can refer to the municipal department tasked with real estate taxation
- it can refer to the database and future key register holding the municipal real estate tax records

In the context of this chapter, WOZ refers to the municipal WOZ department, unless otherwise specified. This department is one of the municipal departments with strong ties to the BAG register, and, as mentioned, handles property taxes. Unlike the BAG register, however, the WOZ database does not primarily use buildings in the sense that the BAG register does. In fact, the WOZ register does not store any kind of geometric data⁹. Instead, the WOZ database, which will itself become a key register in the future, uses WOZ-objects. A WOZ-object can contain both land and physical structures, and may or may not overlap partially or completely with a BAG-building. The primary difference between BAG and WOZ in this regard is that BAG defines buildings physically: *'what are the boundaries of a structure?'*, while WOZ defines them functionally: *'who uses and owns what space for which purpose?'* (Ministry of VROM, 2009d; Waarderingskamer, 2009a; van Dijk¹⁰).

As the above shows, WOZ deals partially with the same objects as the BAG register. The actual contents of the WOZ register are split into three parts: the objects, rights, and the valuation. The *rights* class is comprised of certain rights that a person may have in relation to an object (for example, renting an apartment gives the right to use it). The valuation is the estimated value that the WOZ department of a municipality have attached to a WOZ object. These objects are defined differently for WOZ than for BAG, however, making it difficult to link the two directly. A WOZ-object can contain multiple BAG objects and cadastral parcels. For that reason, the *WOZ-subobject* was invented. A WOZ-object contains one or more WOZ-subobjects. Such a subobject consists of either a parcel, a BAG building, or a BAG occupancy object, and can be linked to the BAG register or the

⁹ However, the WOZ key register catalogue (Waarderingskamer, 2009a) does list WOZ object geometry, as a non-authentic attribute. Municipalities are not required to collect this data, or store it in the WOZ key register.

¹⁰ Mr. van Dijk is the current coordinator of the WOZ department of the municipality of Zwolle.

Cadastral register (BRK). WOZ-subjects are not part of the WOZ key register, but are designed specifically to allow municipal WOZ departments to establish the link with the BAG register.

The data that WOZ supplies to the BAG register relates to buildings and occupancy units, and are attributes like the surface area, status, and construction and demolition dates. Surface area only relates to BAG occupancy units, the others can also relate to BAG buildings. However, note that the occupancy unit surface area that WOZ will supply to BAG is only the sum of the parts that WOZ maintains: WOZ does not store the total surface area itself, only subtotals for the different functional parts of an occupancy unit. This data can then be sent to the BAG register. A unit's construction and demolition dates are self-explanatory. Once a building is finished, or demolished, this is recorded in WOZ, and its year is sent to the BAG register (Ministry of VROM, 2009d; van Dijk).

One last point of interest regarding WOZ is that the Central Facility, or *LV*, for the WOZ register has been postponed due to financial constraints at the responsible Ministry of Finance. There are plans to convert the exchange format for WOZ data to one that is compatible with NORA¹¹, however, which is a national framework for e-government and outlines common data exchange formats (Waarderingskamer, 2009b).

¹¹ NORA: Nederlandse Overheid Referentie Architectuur, or Dutch Government Reference Architecture. It is essentially a framework for e-government services in the Netherlands.

4. Why Key Registers?

This chapter will explore the reasons why the network of key registers was created. It will elaborate on the goals of the key registers, as well as discuss the policy background that influenced these goals. This includes a short discussion of Dutch e-government policy, as well as an introduction into the INSPIRE-directive of the European Union and its links to the network of key registers. Lastly, the concept of SDI, or Spatial Data Infrastructure, will be explored.

Key registers are not single, self-contained projects. The twelve registers that currently exist, or which are currently under construction, are all interconnected, though some are more connected than others (see *Figure 1*). Many documents are available concerning either the network of key registers, or the individual registers. In case of the BAG and BGT key registers, the vast majority of publications is aimed at the BAG register, since that register is currently in the final phase of nationwide implementation, while the BGT register only entered its design phase in late 2009. Those documents that cover the government policy towards the whole network of key registers tend to be largely similar in content, although it is clear that these documents have been refined, updated and expanded significantly since one of the oldest policy documents concerning key registers in their current form was published in 2002 (Programmabureau Stroomlijning Basisgegevens, 2002).

Since then, more policy documents have been published that cover the network of key registers by itself, or as part of a larger program (Duivenboden and de Vries, 2003; e-Overheid, 2008; Ministry of VROM, 2009b). In essence, these, as well as register-specific documents, mention certain requirements that the network of key registers must adhere to. In total, there are twelve such requirements (Ellenkamp & Maessen, 2009; Ministry of VROM, 2009a):

1. All key registers must be established by law
2. Users are required to report errors in the data
3. The entire public sector is under obligation to use the key registers
4. There is agreement concerning liability
5. The finances concerning development and exploitation of the registers is acceptable and clear to all
6. There is clarity about the contents and scope of the key registers
7. Procedures and standards for data exchange are defined
8. There is clarity about procedures regulating access to the registers
9. A clear quality assurance plan exists

10. Agreement exists about the fact that, and method by which, users of key register data are involved in policy decisions
11. The position of any key register is clearly defined, both within the network of key registers and in relation to any other key register
12. The authority over a key register lies with a public entity, and a minister is responsible for the development and functioning of the register in question

4.1 e-Government

While the twelve registers together form the network of key registers, the network as a whole does not exist in a vacuum, either. On one hand it does exist by itself functionally, but it is part of a much broader government program to expand, streamline, and improve the digital services that governments in the Netherlands provide. This broader program for improving e-services is known as the NUP¹², and it covers many projects besides the network of key registers. Examples of six NUP projects can be found in its main policy document, and consist of services that are largely administrative in nature, like the streamlining of the municipal permit process, or assisting businesses in navigating through national and EU regulations (e-Overheid, 2008).

The NUP program is basically the implementation of the e-government policy of the Dutch government. This policy is outlined in a 2008 document (Ministry of Economic Affairs, 2008) that emphasizes the need for e-government and outlines the most important goals for improvement of e-government services. These goals are stated more clearly in the NUP document (e-Overheid, 2008):

- *Transparent government: an individual's rights and duties are clear, understandable and accessible*
- *Supplying data only once: information already known to the government will not be requested from citizens again*
- *Information will be shared and used throughout governments*
- *Decreasing administrative costs: transactions are clear, simple and cheap*
- *Accessibility: citizens, companies and organizations can choose how to contact the government*
- *Municipalities will be able to act as a gateway to all governments*

¹² 'Nationaal Uitvoeringsprogramma Dienstverlening en e-Overheid' or 'National Implementation Program for Services and e-Government'.

The network of key registers, including the BAG and BGT registers, are mostly attempts to satisfy the second, third and fourth points. Many public organizations use similar data for similar tasks, yet they do not always use the same datasets. Since the different data sets all had to be created separately, taking effort, time and money for each, this can be handled more efficiently, hence the key registers. Data is supplied to the sourceholder organization only once, and is entered in the key register, from where all public organizations will have to use it.

National policy created the network of key registers, based on the broader NUP policy regarding e-government (e-Overheid, 2008). However, the NUP policy was based on an earlier report from the Ministry of Domestic Affairs (2008), which outlined the government's reaction to several earlier reports. These reports include the conclusions by the Wallage-Postma commission (Ministry of Domestic Affairs, 2007), as well as an OECD report (2007) concerning the status of e-government in the Netherlands. The Wallage-Postma report is a comprehensive overview of the state of e-government in the Netherlands general, as well as specific projects. The 2007 OECD report is part of a series of reports concerning e-government in many countries, and provides recommendations and inventories important obstacles for the successful implementation of e-government. For the Netherlands, the report's main findings were that the Dutch e-government effort, *"while on track, would benefit from additional guidance and support to all levels of government"* (OECD, 2007, p. 11). The report then goes on to mention the Netherlands as being a forerunner in the quest to reduce the government's administrative burden, which is also one of the goals of the network of key registers. Indeed, the report explicitly recommends key registers as useful 'common building blocks' for e-government services (OECD, 2007).

4.2 SDI

To understand the nature of the network of key registers, as well as its potential influences on an organization, it is necessary to explain the concept of SDI, or Spatial Data Infrastructure. This section will explore the relations between the concept of SDI, and the network of key registers. First, SDI needs to be defined. In literature, there are many definitions of SDI. Some are listed here:

'[SDI is] an enabling platform linking data producers, providers, and value adders to data users'
(Masser, Rajabifard and Williamson, 2008).

'[SDI is] fundamentally about facilitation and coordination of the exchange and sharing of spatial data between stakeholders in the spatial data community' (Rajabifard, Feeney and Williamson, 2002).

'[SDI] encompasses the standards and information technologies, decision-making processes, human and financial management systems, and social structures that govern the acquisition, processing, distribution, use, and maintenance of geospatial information' (Lance, Georgiadou and Bregt, 2007).

De Man (2006) uses several definitions of SDI from literature (including that by Rajabifard et al., 2002) to come to a broader definition of SDIs, which, he says *'...aim at facilitating and coordinating exchange, sharing, accessibility, and use of spatial data and encompass networked spatial databases and data-handling facilities, complexes of interacting institutional, organizational, technological, human, and economic resources.'* De Man also mentions the distinction that Rajabifard, Feeney & Williamson (2002) make. They distinguish two types of SDIs: product-based, and process-based SDIs.

The product-orientation tells that the focus of SDI is the linking of concrete and clearly defined spatial databases, in order to deliver a quality product to the users. This approach can be traced back to the result-oriented thinking of industrial society, and is similar to the 'content' line of thinking in the case of infrastructure such as telecommunication networks: a strong focus on creating a specific product. On a more abstract level of thought, this translates to the 'demand pull' orientation, where a new technology is introduced because of specific demands from users (Rajabifard et al., 2002; Coleman & McLaughlin, 1998). Opposite to this line of thinking is the process-oriented approach to SDI, which places less importance on making available a specific dataset, but rather focuses on managing information assets, and creating communication channels through which information can be made available (Rajabifard et al., 2002). This mode of thinking has more in common with the 'conduit' line of thought from Coleman & McLaughlin (1998), regarding telecommunications infrastructure, which also focuses on enabling the flow of information, rather than making available specific information. On a higher level, this idea can be linked to the 'technology push' concept, which also deals with enabling rather than directly creating anything (Rajabifard et al., 2002; Coleman & McLaughlin, 1998).

On a lower level of abstraction, in the realm of actual spatial data, Van Loenen (2002) analyzes the distinction found in literature between 'framework datasets' and 'thematic datasets'. The former consists of a minimal dataset, which can perhaps function as a reference point for other data, or to

link one or more datasets to itself or each other, while the latter contains data about a specific subject (Van Loenen, 2002; Phillips et al., 1999; Onsrud, 1998). Thematic datasets can be said to be aimed at specific uses or users, and fit in largely with the product-based approach to SDI, and the ‘conduit’ and ‘demand pull’ approaches to infrastructure and technology. Framework datasets work as enablers, and thus fit with the process-based approach to SDI, as well as the ‘content’ and ‘technology push’ concepts in relation to infrastructure and technology (Rajabifard, 2002; Coleman & McLaughlin, 1998). It should be noted that the process-based approach to SDI is related to higher hierarchical levels of SDI, while the product-based approach relates to lower hierarchical levels of SDI (Figure 3).

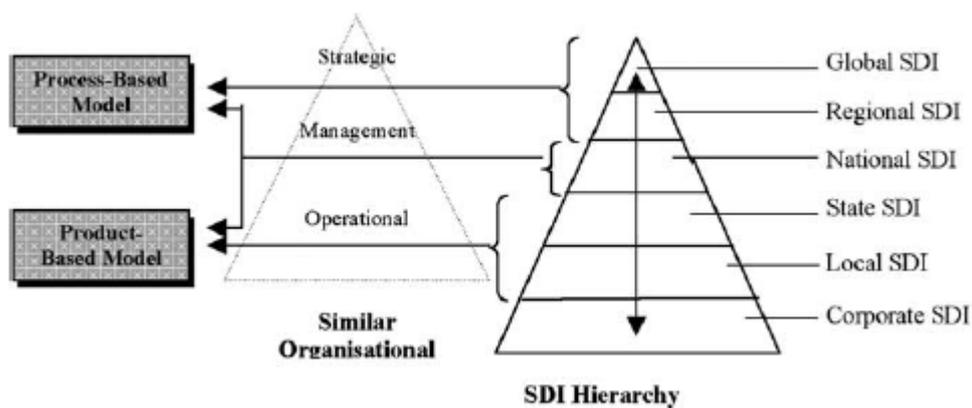


Figure 3. Hierarchy and the process- and product-based approaches to SDI. Source: Rajabifard et al., 2002

If this division is applied to the network of key registers, it becomes clear that they contain both the product-based and the process-based approach. The product-based approach can be seen in the direct links that are being made between the various key registers, with the goal of making specific datasets available to a wide audience of public institutions. On the other hand, the (spatial) datasets made available are both thematic and framework datasets, or a combination of both. The BAG register, for example, does not only contain framework data like the municipal address list, but also thematic data like the surface area of the occupancy units related to those addresses. In addition to this, the concept of plusinformation is also indicative of the process-orientation of the network of key registers: municipalities are encouraged to add their own local information to a key register’s authentic data which they are obliged by law to use. This plusinformation is more closely linked to SDI on the local level, and the product-based approach to SDI, while the authentic information is more often enabling information that is part of the process-based approach of a national SDI (Figure 3).

Another important characteristic of the spatial key registers is the object-oriented nature of the spatial data in the BAG and BGT registers. Objects can be more easily linked with other data than the line-based maps used previously, which enhances the process-oriented functions of the BGT key register: it is now much easier to link external thematic data to the framework data in the BGT. When all these factors are taken together, the conclusion is that the network of key registers contains both a product- and a process-oriented approach, while the BGT is mostly a process-oriented framework dataset, and while the BAG register also contains thematic elements and partly fits the product-oriented line of thought regarding SDI.

4.3 EU Policy

The European Union also influenced the development of the network of key registers through a directive called *Infrastructure for Spatial Information in the European Community* (INSPIRE). This directive was proposed in 2004, and adopted in 2007, in order to improve the sharing of spatial information within and among public organizations in EU member states. The directive seeks to establish spatial data infrastructures (SDI, see above) in order to accomplish a greater level of sharing of spatial information within the European Union. The justification for this initiative to improve the sharing of information is that:

[information] is needed for the formulation and implementation of [environmental] policy (...). [I]t is necessary to establish a measure of coordination between the users and providers of the information, so that information and knowledge from different sectors can be combined.

(...)

[t]he problems regarding the availability, quality, organization, accessibility and sharing of spatial information are common to a large number of policy and information themes and are experienced across the various levels of public authority and across different sectors.

(...)

An infrastructure for spatial information in the Community should therefore be established.

[INSPIRE directive, p. 1]

In essence, INSPIRE describes the decision of the European Commission that successful environmental policy requires reliable information on a wide array of subjects, and member states should develop infrastructure to make their existing information from relevant fields more easily available. While the network of key registers is not directly mentioned in the INSPIRE directive, the

data stored in several key registers, like the Cadastral BRK register, as well as the BRT and BGT topographic registers, are definitely relevant to environmental policy. As such, EU member states should take steps to share this data under the INSPIRE directive. In the Netherlands, the INSPIRE directive is implemented in GIDEON¹³, described as a standard geo-information service for the Netherlands (Ministry of VROM, 2008b). The four main goals of GIDEON are that geo-information should be more commonly used, both by citizens, governments, and the private sector:

- Citizens and companies should be able to request geo-information pertaining to any location in the Netherlands.
- Private companies should be able to create value added services to any public geo-information.
- Governments and other public institutions should co-operate with the private sector in order to develop the standard geo-information service further.
- Governments uses all available information for any location in her services and working processes.

It is this last point especially which is relevant to the network of key registers. More generally speaking, the GIDEON project aims at greater efficiency in government through the re-use of available data, as well as improving services towards citizens and companies. The wider availability of geo-information is also intended to aid economic growth and the creation of jobs. Several of the GIDEON goals previously discussed can be linked to the network of key registers, but they are also explicitly mentioned as part of the GIDEON implementation strategy. Through GIDEON, the INSPIRE goals are translated into national policy, linking them with the network of key registers as well.

¹³ GIDEON: Geografische Informatie en Dienstverlening ten behoeve van de E-Overheid in Nederland

5. Compatibility of BAG, BGT and WOZ registers

This chapter seeks to further analyze the consistency of the spatial key registers. This will be accomplished by exploring several issues: the degree to which the contents and definitions of the BAG and BGT registers are compatible with each other, the degree to which the BAG and BGT registers are compatible with their intended goals and usage, and the degree to which BAG and BGT are compatible with the stated goals of the network of key registers and the NUP program.

In the case of the BGT register, its main goal is explicitly mentioned in the register's main policy document: The entire government will use the same basic set of data for large-scale topography of the Netherlands (VROM 2009c). In order to evaluate the capacity of the register to meet its goal, the (proposed) contents of the register must be examined. Essentially, the BGT key register's possible contents are defined by three restrictions. First of all, the BGT register is made to contain topographic elements. Topography is sometimes defined as containing only physical elements, like rivers, mountains, or buildings (Burrough & McDonell, 1998), but can also include non-physical elements (Heywood, Cornelius & Carver, 2006). The BGT register focuses on the physical elements (see chapter 3), with the exception of virtual 'superclasses', the subclasses of which are again entirely physical in nature.

A second restriction to the contents of the BGT lies in the fact that the BGT register is meant for large scale topography, as the name suggests. As such, the register should only contain elements that can reasonably be represented on a large scale map. In case of the BGT, 'large scale' means elements visible between the scales 1:500 and 1:5000.

The third (somewhat subjective) restriction is the fact that any key register will store information that forms a basic data set that all Dutch governments should use, where possible. For that reason, the information that will be stored in the register should be information usable by multiple parties. After all, if information in a key register is used solely by a single public entity, then there are no gains to be made by demanding that it be stored in a tightly controlled, mandatory-use key register. Data in key registers, then, should be data that is used frequently by multiple public organizations (Ellenkamp, Krijtenburg). Implicitly, this point is also supported by the 'mandatory usage'-clause of the network of key registers, as outlined in the main NUP document (e-Overheid, 2008). After all,

mandatory use of any kind of data by public institutions does not make sense, unless there actually are multiple users of that data.

One of the major features of both the BAG and the BGT key registers is the inclusion of building geometry. Every building in the Netherlands will have its geometric shape stored in these registers. However, as can be seen in chapter 3, the BAG and BGT registers do not agree on what a building's geometry should be. In the BAG register, the choice was made to record the shape of a building as seen from above ('top-down'). A document detailing the geometric side of BAG mentions that this way, the maximum size of the building is covered (Ministry of VROM, 2008a): if any part 'sticks out', it will still be part of the building's geometry in the BAG register. However, no explicit argument is given here, nor in other BAG documents, as to why this type of geometry should be stored. There does not appear to be any user who specifically needs this type of geometry, at least within the municipality of Zwolle. Outside Zwolle, however, there also do not appear to be any public actors requiring its use (van der Lely¹⁴, Krijtenburg). For this reason, the difference in geometries can be seen as being contrary to the spirit of the sixth goal of the network of key registers, which calls for clarity in the contents and scope of the registers (Ministry of VROM, 2009a).

One possibility is that top-down of geometry was chosen in order to make it easier to use aerial photography for the creation and maintenance of the BAG building map. While this theory is mentioned as a factor by Ellenkamp¹⁵, it was not the main reason for this choice. According to her, the main reason why the ministry of VROM chose the top-down geometry is indeed the reason given in the BAG geometry document (VROM, 2008a): in order to capture the largest shape of the building. This choice was motivated by the nature of the BAG register: a central database that contains all important information about addresses and buildings. This register is specifically focused on buildings, as opposed to the BGT register, and its current predecessor, the GBKN base map. For that reason, it was thought to be important to be able to visualize the outermost limits of any building, both in general, as well as for specific tasks such as aiding emergency services (Ellenkamp; Grashoff, 2009). However, it is worth mentioning that the GIS coordinator of the IJsselland emergency services region, mr. Jaap Smit, claims to prefer ground-level geometry, in combination with aerial photographs in case any top-down geometric information is needed (Smit).

¹⁴ Mr. van der Lely is a senior consultant at Grontmij BV, specialized in software used for maintaining the GBKN base map and BOR databases.

¹⁵ Ms. Ellenkamp is a civil servant working for the ministry of VROM. Her primary task involves coordinating the compatibility between the various key registers.

The BGT register, on the other hand, will store ground-level building geometry. This is also the type of building geometry contained in the GBKN base map that is currently used. In any case, BAG and BGT will together store both types of geometry for all buildings, and these will be linked with each other through each building's unique identifiers. Ideally, a single type of geometry would be chosen to represent buildings in both spatial key registers (Keppel¹⁶, Van der Lely). However, one fact to keep in mind is the large degree of similarity between the total municipal BAG and BGT building geometry: many buildings have the same geometry for both the top-down and the ground level view. Many others have geometries that are only slightly different between the top-down view and the surface level. These may very well fall within the current margin of error for BAG geometry, which gives leeway of one meter (VROM, 2008a). The vast majority of buildings will have a top-down geometry that is sufficiently different from the surface level geometry, in order to necessitate the storage of both types of geometry. VROM (2008a) estimates that about 5% of all buildings would possess two geometric shapes. Municipalities, then, are likely to simply copy their newly made BAG-building database into the BGT register, while using survey teams to map those buildings that do have ground-level geometry different from its top-down counterpart (Krijtenburg).

In addition to the major similarities between BAG and BGT building datasets, the use of object-oriented databases makes this imperfection manageable, since one type of geometry can be easily linked to another, through their unique identifiers. They can also be integrated further using technical solutions that may synchronize the two types of geometry (Van der Lely). Ellenkamp also mentions another factor that diminishes the divide between BAG and BGT building geometry: municipalities can process both geometries simultaneously. In case of terrestrial surveying, both geometries can be surveyed simultaneously by the surveying team. Municipalities may very well store both types of geometry in a single geodatabase, together with their local plusinformation (Ellenkamp, Krijtenburg). From this central geodatabase, relevant parts can be shared with the BAG and BGT key registers at will. The eight surveyed municipalities also mention that the degree of compatibility between BAG and BGT is somewhat lacking, but manageable. The lack of compatibility between BAG and WOZ is generally seen as a bigger problem.

As mentioned in chapter 3.4, the WOZ key register does not contain authentic geometry for its WOZ objects. In fact, WOZ objects only refer to any BAG or BRK object they have a relation with, while

¹⁶ Mr. Roelof Keppel is the current project leader tasked with the implementation of the BAG register at the municipality of Zwolle.

containing only administrative data itself. WOZ objects are also not limited spatially (i.e. to a single building or parcel), but can instead contain a mixture of many. The sole determinant of the limits of a WOZ object is the owner/user of the object, a functional limit. If adjacent buildings or parcels of land are owned and used by the same person, then these parcels and buildings will together form a single WOZ-object. On the municipal level, however, WOZ-objects are formed using WOZ-subobjects, which are again limited spatially, and consist of a single parcel of land (from BRK, the cadastre), BAG-building, or BAG-occupancy object. The eight surveyed municipalities are generally critical of the lack of compatibility between BAG and WOZ. Some of them recommend that using spatial definitions for WOZ contents would make the relationship between the WOZ and BAG registers stronger, allowing for easier spatial analysis of WOZ-objects. The ability to easily link data from several key registers is, after all, one of the advantages of a system like the network of key registers. WOZ-subobjects can be linked to BAG and BRK more easily, and would allow better spatial analysis. Unfortunately, the use of WOZ-subobjects is limited to municipal use, which means that other institutions, or possibly other municipalities, will only be able to use the non-spatial WOZ-objects in the WOZ key register.

The major point that can be concluded from this chapter, regarding the compatibility of the BAG, BGT and WOZ registers, is that the BAG and BGT registers are not fully compatible with each other. Their building geometries are different, with the BAG register demanding top-down geometry, and the BGT demanding ground level geometry. Meanwhile, the stated reasons for this difference do not fully justify it from a user perspective. Still, from a practical point of view, this incompatibility does not appear to cause any major problems, for several reasons. There is a possibility that municipalities will choose to store and maintain spatial BAG and BGT data in a single database, from which relevant data can be sent to the key registers when needed, diminishing the practical difference between BAG and BGT building geometry in municipal databases. This is furthered by technical solutions that could synchronize BAG and BGT geometry, as well as the possibility of simultaneously surveying a building's ground level and top-down geometry. Lastly, since a vast majority of buildings in any municipality will have few differences between their top-down and their ground level geometry, municipalities can simply copy BAG geometry as BGT geometry for many buildings.

However, the degree of compatibility between the BAG and WOZ registers appears to be more difficult to improve. Surveyed municipalities mention the lack of geometry in the WOZ register, and the indirect connection between WOZ-objects and BAG-objects. Both issues impede spatial analysis of WOZ data, which would otherwise be a major advantage of the adoption of the network of key registers. Municipalities may want to use WOZ-subobjects as much as possible, in order to strengthen the relations between the WOZ and BAG registers, since WOZ-subobjects can be linked

1:1 to a BAG- or BRK-object. However, the Central Facility for the WOZ key register does not contain WOZ-subobjects, and as such only the sourceholder municipality can use the advantages that the WOZ-subobjects have over regular WOZ-objects.

Above are examples of how a greater degree of compatibility between BAG, BGT and WOZ registers may be realized. The reason that these methods are necessary, however, do originate at least partially from a lack of compatibility in the design of the registers. While the responsible ministry (VROM) does appear to be trying to minimize this incompatibility, a greater effect may be the mandatory nature of the key registers. Because of this, municipalities (as well as their private sector suppliers) are pressured to come up with solutions to the practical problems that follow from the incompatibility between the BAG, BGT and WOZ key registers. In case of the BAG and BGT geometric incompatibility, these solutions should diminish actual problems to a manageable level, which is in line with the expectations of surveyed municipalities. The differences between WOZ and BAG receive more criticism from municipalities, and appears to be more difficult to solve. Using WOZ-subobjects appears to be the best method of guaranteeing strong links, on the municipal level, between the WOZ and BAG register.

6. Organization of spatial data at Zwolle

Like any municipality, Zwolle makes frequent and diverse use of spatial data. Examples are datasets of the municipal road network, of trees and other green areas, or data concerning buildings and other topographic objects. Some of these datasets will, in the future, be stored in the BAG and BGT key registers. However, the introduction of these registers also provides an opportunity for the municipality of Zwolle to overhaul the organization and methods used for the collection, maintenance, and storage of such spatial datasets. This chapter seeks to explore the current data organization, as well as providing possible directions for the future. Specifically, the influence of, and possibilities offered by the BAG and BGT key registers will be discussed.

6.1. BOR and BGT integration

Beheer Openbare Ruimte (*Public Spaces Maintenance*), or BOR, covers those personnel at the municipality of Zwolle who maintain spatial databases dealing with public space and its infrastructure. This includes sewers, streets, trees, and more. These databases are updated as changes are made to the physical objects they represent, but also serve as a source of information to plan and direct maintenance to the infrastructure. Of BOR's three main components at Zwolle, roads are the only objects that will likely be BGT content. Sewers are underground networks, and as such will become part of the WION¹⁷ database in the future, while trees and other 'green' objects will likely not be part of any key register for the foreseeable future. All BOR data at Zwolle is managed separately from the municipal topographic base map GBKZ.

Currently, there is still a wider discussion going on between various parties with official or unofficial influence on the content of the BGT register. On one hand there are those who feel that the BGT should only include the most fundamental datasets, while on the other hand there are those who wish for a more detailed register. Road data was a prime example of this discussion. BOR uses a detailed database of road segments, for road maintenance and other purposes. These segments, like bicycle paths, parking spots and speed bumps, are defined by the material they are made of, as well

¹⁷ Wet Informatie-uitwisseling Ondergrondse Netten: a database (though not a key register) for underground pipelines and cables.

as most height differences and sometimes differences in delineation (Piersma & te Velthuis¹⁸). The question for roads as BGT content lies in whether to include this more complex road data, rather than a simplified version that would just contain entire road sections, without much detail, spanning up to several hundreds of meters. If the more complex version of the road network is chosen, BOR will be able to use the BGT directly for their road-related tasks, instead of storing road segment data separately.

Arguments exist for both sides. On one hand, the BGT's aims are to have all governments use the same fundamental datasets. Including the more complex road data broadens the amount of users of the BGT register (Keppel). Second, if a simple version of road data is instead included in the BGT, the complex BOR road data will still need to be compatible with the simpler version in the BGT. On the other hand, a simpler BGT means that there are fewer costs attached to creating and maintaining the register. Also, some municipalities (especially smaller ones) sometimes do not yet possess spatial road data, or only data of insufficient quality (van der Lely). Including detailed road data could make the BGT a heavy burden to these municipalities. In the questionnaire created for this thesis, the smaller municipalities supported a more complex BGT register, however, as did some larger ones. In total, about four of the eight surveyed municipalities were in favor of the complex BGT, while the other four were mostly neutral, expressing no preference.

It should be noted, however, that full inclusion of detailed road segment objects in the BGT is unlikely, according to mr. Dick Krijtenburg, one of the members of the working group responsible for the contents and definitions of the BGT register¹⁹. In case that the simpler variant of the BGT becomes reality, municipalities still have the option of adding their own road segment data to their municipal base map. According to Krijtenburg, however, efforts are being made to implement a certain level of compatibility between the BGT's road content, detailed municipal BOR road data, and the Cadastral small-scale road data (1:10,000). This compatibility has two main goals: the first is to provide the possibility of linking the different datasets, so that small-scale road segments will be linked to the larger-scale segments that are part of it. The second goal is to assist in the generalization of road data. Generalization of spatial data is the process where spatial data on a certain scale is automatically derived from data from a larger scale. In this case, it would mean that detailed BOR road segments could be automatically combined into complete BGT road sections, which can then be used to form 1:10,000 roads in the Cadastral files (Krijtenburg).

¹⁸ Both work at the municipality of Zwolle, tasked with the maintenance of BOR data.

¹⁹ Mr. Krijtenburg is also a geo-information specialist at the municipality of Amsterdam.

Current efforts appear to focus on making sure that a well-defined relation between detailed road segments and larger road sections will exist (Krijtenburg). This appears to be one way in which a compromise is reached between proponents and opponents of a more detailed BGT: the level of road detail in the BGT will be kept low, but a framework is created to allow individual municipalities to easily integrate their BOR road data with the BGT register. While this solution thus limits direct use of the BGT, it may create more support among those municipalities that lack the resources to integrate BOR and BGT, while maintaining a partial solution for those municipalities that do want integration. It appears to be a compromise solution, enacted for reasons that are not only technical, but also political in nature: creating consensus for the contents of the key register.

6.2. Data collection: aerial photography and terrestrial surveying

Key registers bring a variety of potential changes to the municipality of Zwolle. The first challenge lies in examining these changes that the key registers may bring to the administration of the spatial databases of the municipality of Zwolle. The current GBKN topographic base map, or the municipality's own local GBKZ variant, is created mostly through terrestrial surveying. Elements on the map were surveyed as either point or line data, and classified accordingly. The BAG key register, however, requires object-oriented building geometry for any structure inside the municipality's borders that fits the BAG criteria for buildings. Essentially, these criteria read that an object must be sufficiently structurally independent, as well as be adequately connected to the earth. However, unlike GBKN geometry, BAG building geometry requires a top-down view of all relevant structures. Since this type of geometry was not previously used at Zwolle, as well as most other municipalities, there was no existing database from which this information could be derived, meaning that all of it needed to be newly created. Zwolle, as well as many other municipalities, decided to use aerial photography to create the BAG-compliant building database²⁰.

However, creation of spatial data is one thing, but in order for such data to be useful in the long term, it needs to be maintained. Buildings that are demolished must also be removed from the database, and changes made to structures must also be made to the objects that represent them on the map. However, there are multiple methods that can be used to maintain spatial databases in this

²⁰ With aid of the current GBKN map, which was often used for reference.

way. The most commonly used methods have both been mentioned above: terrestrial surveying and aerial photography. In addition to this, the GBKN base map (as well as the future BGT register) also allows input from building- and project plans to be temporarily used, until the finished building or infrastructural project can be measured using some other method. Often, plan-geometry will remain in the GBKN database as permanent objects, after the spatial quality of the plans (or, more commonly, a number of sample objects) has been ascertained using regular methods.

Recently, the Ministry of VROM commissioned a survey (Colfield, 2009) to be held among all Dutch organizations that will manage data for the BGT key register. These organizations (sourceholders) are municipalities, provinces, and water boards, as well as the rail infrastructure company ProRail and the national infrastructure authority Rijkswaterstaat. In total, 438 of the 477 organizations responded to the survey, or 92%. In relation to the method of maintaining their spatial databases, 63% of the organizations surveyed responded that they used aerial photography to some extent, as a source from which updates and changes ('mutations') to their spatial data are derived. (see **Figure 4**). However, it is possible that these organizations also use other methods in combination with aerial photographs. Of those organizations who answered the question positively, two-thirds said to use aerial photographs to process building mutations, while half claimed to use aerial photography to process all GBKN mutations (**Figure 5**). In absolute numbers, for all 438 organizations surveyed (including 398 municipalities), 274 responded that they use aerial photographs as a source for mutation processing, of which 136 say to use his method as a source to process all mutations to the GBKN base data.

These figures indicate that using aerial photography is a popular method of processing object mutations, among those sourceholder organizations that will likely manage BGT data (the vast majority of which are municipalities). While no similar data is available for terrestrial surveying, it also remains a common method of updating spatial databases in accordance with changes in the physical landscape. The eight responses to the questionnaire among municipalities indicate that terrestrial surveying is still the most common method, and several municipalities claimed to use it exclusively. Aerial photography appears to become more common as a method as well, and is also mentioned by the majority of responding municipalities, though always as part of a mixture of methods used.

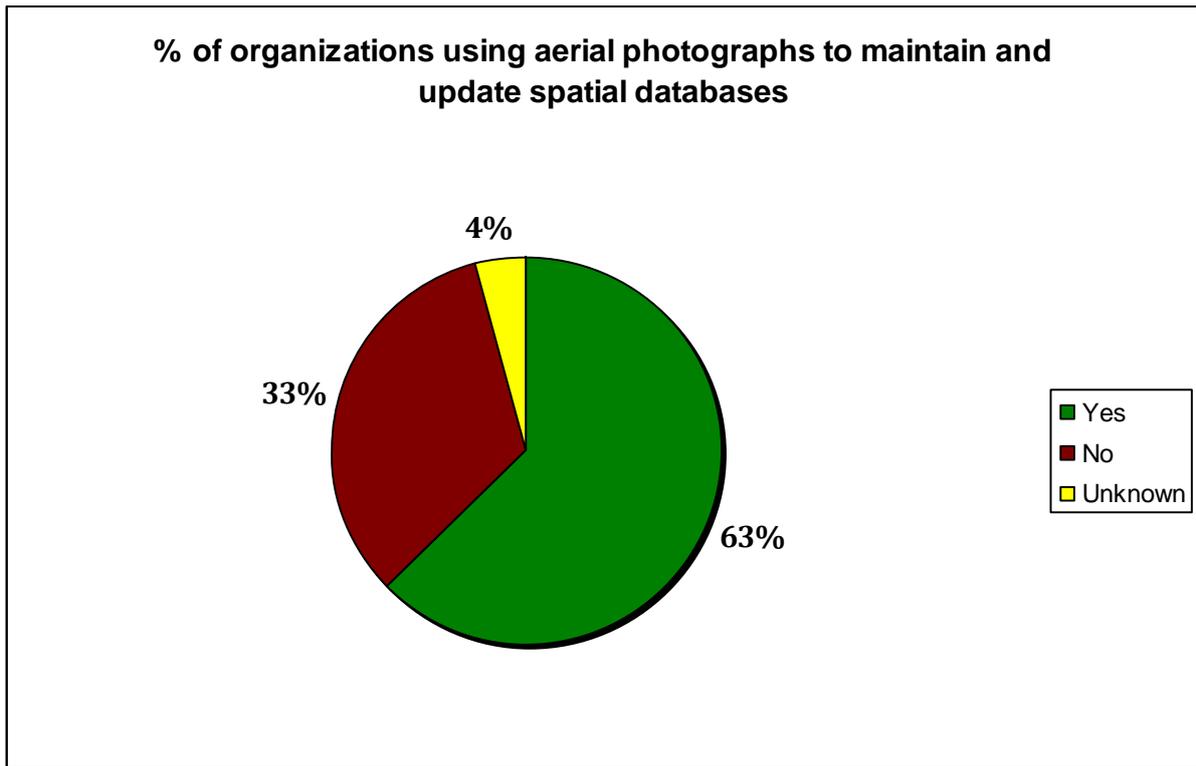


Figure 4. Sourceholders using aerial photography to maintain and update spatial databases. Based on Colfield (2009)

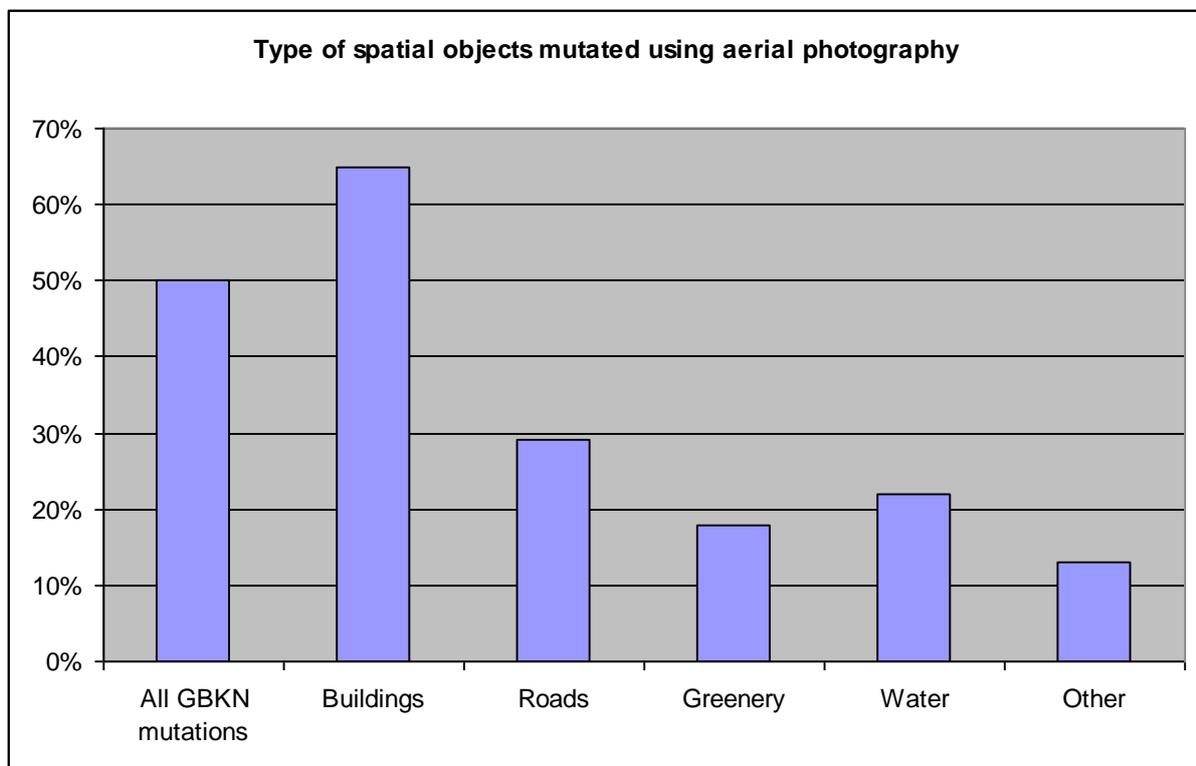


Figure 5. Contents of mutations processed using aerial photography, expressed as a percentage of all sourceholders using aerial photographs for mutation processing. Based on Colfield (2009).

The use of aerial photographs as the primary method of processing mutations is not entirely without downsides, however. In general, the possibility to make aerial photographs is dependent on several factors, like the weather (because of clouds) and the seasons (because of lighting and vegetation). Normally, such practical issues prevent aerial photographs from being made more than twice per year (assuming reasonable intervals between photographs). Usually, aerial photographs are made during the spring. Additional limitations concerning the creation of aerial photographs are the difficulty of mapping structures that are obscured, to some degree, as well as the inflexibility of the scheduling: topographic changes that have occurred shortly after the photographs were taken, may well remain left out of the topographic map until the next year. This may not only be inconvenient to the municipality itself, but can also lead to problems when such data is uploaded to the national topographic base map GBKN, or the future BGT, since there are limits to the temporal inaccuracy that any object may have. In case of the current GBKN map, BAG buildings and major infrastructure are not allowed to be more than six months out of date. This limit is doubled for miscellaneous topography (twelve months) and doubled again (twenty-four months) for rural areas (Stichting GBKN, 2007). Some flexibility exists for these rules, however, because major construction works can be mapped partly or completely at the same time, even if parts are not completely finished, as long as its geometry is clear.

Terrestrial surveying, on the other hand, is more flexible, in that it is largely independent of weather or season, and is also much more precise than aerial photographs. However, with the continually improving quality of aerial photographs, this advantage is becoming less important. Since terrestrial surveying is much more labor intensive, the cost of measuring an object is generally higher. When the BAG register was introduced, municipalities often opted to use aerial photographs to create the initial BAG building map, like Zwolle did as well. The reason was that, as mentioned above, aerial photography is a good method to map large areas in a short timeframe. For infrequent, continual changes spread across a large area, terrestrial surveying could still play a role in the near future. As soon as the municipality receives information that a certain building or other construction is completed, surveyors can be sent to measure it. Terrestrial surveying may also be easier in the minority of cases where BAG and BGT building geometry differ, since these buildings can then be surveyed simultaneously. On the other hand, small changes to buildings do not always require a municipal permit, even though they can lead to clear changes in the geometry of the building (Ytsma²¹, 2010). These changes can go unnoticed by the municipality, leading to (eventually) outdated topographic maps. In such cases, and in cases where large construction projects cause

²¹ Mr. Ytsma is the coördinator of the BAG database at the municipality of Zwolle.

many changes to an area in a short timeframe, aerial photography can map all changes more easily. Similarly, objects on inaccessible private premises provide difficulties to terrestrial surveying, where aerial photography does not have such access limitations. Plan-geometry can be inserted into a map at all times, directly from the building or project plans, but still needs to be checked using other methods.

The responses to the municipal questionnaire were mixed on this subject. Most use multiple methods for the collection of spatial data. Some say they experience or expect a shift towards more intensive use of aerial photography. Terrestrial surveying is still used by all eight responding municipalities, however. Both the high quality of the measurements, and the time restrictions are mentioned as reasons for the use of terrestrial surveying, as well as tradition.

For the near future, it seems difficult for any mapping method to replace all other, since all possess unique qualities. The initial BAG building map was also a somewhat unique situation, where aerial photography was an ideal method to use, because large areas needed to be completely mapped in a short time. However, it is more difficult to use for regular maintenance of the topographic map. There, small, incremental changes are constantly occurring, and it may be difficult to ensure that the topography does not become outdated according to GBKN/BGT requirements. However, for rural areas these requirements are not restrictive to aerial photography. Also, inaccessible grounds and minor topographic changes may lend themselves well to the collection of spatial data through aerial photography. In case of urban centers and core topography, aerial photography can perhaps be used in combination with terrestrial surveying and plan-geometry. In the end, the choice as to which method to use for the maintenance of topographic databases will have to be determined on a case-by-case basis, depending on the desired measurement quality, the type of object, rural areas vs. urban centers, and cost.

6.3. BGT sourceholders

As explained in chapter 3, the organizations that will supply the BGT key register with data are mostly the various governments in the Netherlands. The municipalities, of which there are 430 at this moment, are by far the biggest sourceholders, supplying the vast majority²² of data that will form the

²² Somewhere around 95%, although the precise percentage is impossible to calculate.

BGT. Other sourceholders include the provincial government, the national government, the water boards, national infrastructure organization *Rijkswaterstaat*, and the railway management company ProRail. Each group of sourceholders operates in the same geographical area as the other groups: any given area can contain topography 'owned' by multiple sourceholders, like municipal buildings, national and provincial roads, a waterway maintained by the local water board, and a railway maintained by ProRail.

For this reason, there has been some discussion concerning the status of the municipality within the system of BGT sourceholders. Instead of most sourceholders each maintaining about 1% of all topographic data, and the municipalities maintaining the other 95%, it can be argued, why not let the municipalities take over the remainder as well? Municipalities could then act as the sole organization dealing with the topography inside their borders. This way, it would become easier to maintain the topographic map, since, as Van der Lely points out, certain difficult situations would be simplified. An example is a municipal road crossing a road maintained by the national government. If both datasets were maintained by the relevant municipality, it would avoid issues such as one part of the intersection being updated, but not the other. That does not necessarily mean having to transfer all responsibility of maintaining national road data to the municipalities, however. An alternative organization structure could be that municipalities maintain the spatial databases for the other sourceholders, but the latter still provide the updates and changes to the topography through their own organizations (Van der Lely). Municipalities could then integrate all topographic data within their borders, as well as provide it to the Central Facility (LV) of that key register, while at the same time this approach still leaves the other source holders a certain amount of control over their data. The eight surveyed municipalities provide divided responses to this question, some preferring to become the sole sourceholder, some preferring to act as a gateway for other sourceholders in their area, and some preferring multiple sourceholders. No single opinion is dominant among the respondents.

Without any changes to the concept of many different sourceholders, there are still ways in which individual organizations can work together to optimize their spatial data administration. The Colfield report, commissioned by VROM to investigate the current status of large-scale topography at future BGT sourceholders, shows that there is room for cooperation between sourceholders. Two classes of data, trees and traffic signs, appear to be used by many sourceholders on various levels of government: municipal, provincial, the water boards, etc. Since neither class will be BGT content, both can be considered plusinformation. Since the various sourceholders' territory overlaps geographically, it is possible that both classes either suffer from redundancy or decentralized

maintenance. In the first case, the same objects are stored multiple times. For example, provincial and municipal databases both contain certain trees. The second case, decentralization, is a situation where the different sourceholders both maintain a tree database, and while no tree is stored twice, it would be easier if the sourceholders cooperated and shared their data. This way, only a single sourceholder would need to maintain a tree database for a certain area.

Trees are part of a municipality's BOR data, used for maintaining public space. Colfield (2009) shows that many sourceholders maintain tree databases: half of all Dutch municipalities do so, as well as almost all provinces, four water boards (out of 26), and one of the two miscellaneous sourceholders, Rijkswaterstaat or ProRail. In theory, the same tree could be stored in four different databases, or surrounding trees could all be stored in different ones. Both situations are impractical and inefficient from a maintenance point of view, and a shared database between municipalities, provinces and Rijkswaterstaat/ProRail is worth investigating. However, since about half of all municipalities do not store tree data, such cooperation should probably not be forced onto all sourceholders by adding it to main BGT content. Rather, cooperation between sourceholders should be investigated on a case-by-case, or region-by-region basis.

6.4. Central data management

In addition to the possibilities for the integration of BOR and BGT road data, which is explored above, it is also possible to take this concept one step further, by centralizing data management in a municipality. There appears to be a national trend towards such centralization (Keppel), which appears to be confirmed somewhat by the questionnaire among the various municipalities, who are either considering centralization of the management of spatial data, or who were already considering or implementing independently of the key registers. Currently, Zwolle is already taking the first steps towards more central control over their spatial and non-spatial data. Its GGV²³ project includes linking Zwolle's various databases, which includes linking the municipal GBA and BAG registers.

Creating such links on a municipal level is important to the concept of key registers, since it promotes their goal of widespread use (Ministry of VROM, 2009a). It is also reflection of the links that are established between the key registers on a national level (Ministry of VROM, 2009b). The relations between GBA and BAG, especially, are important to municipalities. Both registers contain information about residents of the municipality: the BAG contains the list of valid addresses within the municipality, while the GBA stores the address where new residents claim to live. Obviously, these two address lists do not always match, for example because of ignorance, honest mistakes, or outright fraud. By linking these systems, like the GGV project will do, any new entries into the GBA can immediately be checked against the municipal BAG address list. While the GBA registers are legally obliged to accept any address given by new residents²⁴, links with the BAG could ensure that a warning is issued by the computer system when a non-BAG address is entered into the GBA. The municipality can then immediately investigate the issue.

In much the same way, other databases can also provide efficiency benefits when they are linked to some degree. However, simply linking the databases is only one of several possible steps that can be taken to centralize data management. The next steps could involve centralized control over the collection of data, and can ultimately lead to the establishment of a complete municipal department

²³ Gemeenschappelijke Gegevensvoorziening – this term can be roughly translated to *Common Data Service*.

²⁴ Although it is argued by Krijtenburg that this should no longer be the case, because it impedes fraud prevention.

tasked with collection, maintenance, and dissemination of all municipal data: personal records, tax records, spatial data, etc.

Centralizing only the control over data collection would involve relatively few organizational changes. Essentially, those departments that currently collect various data will no longer do so completely independently; rather, their personnel can be tasked by a central authority to collect not just their own department's data, but data wanted by other departments as well. This way, when a surveyor travels to a recently completed building that needs to be surveyed for the BAG map, he might also be requested to go to a nearby area. There, maybe he takes pictures of the house for WOZ taxation, or maybe he will attempt to find out which residents live there, or briefly investigate littering of the area, if there have been complaints in that regard. Similarly, surveyors sent out to map a new road for the municipal topographic base map should simultaneously survey BOR road segments. This has obvious advantages in cost, since combining such tasks prevents every municipal department from sending their own people to the same area. Krijtenburg mentions a similar potential for the municipality of Amsterdam, suggesting that a single person should handle various inspection tasks in 'his' area. Care should be taken, however, that personnel is equipped to handle their diversified tasks (Keppel). This covers personnel skills, but also equipment and communication channels between the central department and the decentral data collection personnel.

If centralization of data is taken one step further, then various data collection tasks are removed entirely from their respective departments, and merged into a central data collection department. This obviously creates greater changes in the organizational structure of the municipality, but would allow for easier communication between the central data collection department and data collection personnel, compared to decentral collection controlled by a central authority.

Centralization of the collection of municipal data can also be combined with centralized maintenance: municipal data is collected, stored and maintained by the central data department. Other departments no longer collect and maintain their own data, as far as this is possible in practice (there could be legal or practical constraints, for instance if data collectors and maintainers are also its main users). If necessary, some personnel could be trained in the collection and maintenance of more diverse types of data, and the department would serve all municipal data needs. It is also this department that would supply the Central Facilities of the twelve key registers with the data they demand.

This type of complete centralized authority over all municipal data management is aided somewhat by the introduction of the BAG and BGT geometry data, which, as mentioned before, differ from each other. Where BAG requires top-down geometry of all buildings, the BGT register stores it on ground-level. Municipalities, however, are already expected to simply copy their newly created BAG geometry files into the BGT register, and only survey the ground-level geometry of those few buildings where it is clearly different from the BAG-geometry (Krijtenburg). Ellenkamp expects municipalities to store BAG and BGT geometry in a single database, from where relevant data is sent to the Central Facilities. Furthermore, she also expects a high level of centralization of data management at municipalities in the future, where the majority of all municipal key register data will eventually be stored in a single database (Ellenkamp).

Problems may occur where there are legal or organizational difficulties in arranging municipal data management in this way. As Krijtenburg mentions, the municipality of Amsterdam cannot easily integrate their BOR data with the municipal base map, because the various boroughs of Amsterdam have traditionally maintained their own BOR-datasets, and as such, major incompatibilities exist between their BOR-systems. However, Krijtenburg adds that Amsterdam may well be the only municipality with this problem. Still, in such cases, centralization could be limited to central control over data collection.

All in all, there are possibilities for centralizing certain data collection and inspection tasks. The key registers appear to stimulate the centralization of municipal data to some degree, according to Krijtenburg, Ellenkamp, and the eight responses to the municipal questionnaire. As far as such tasks are not already integrated, there may be possibilities for combined GBKN/BOR surveying, though this would work best if the databases themselves are integrated as well. Some other data collection tasks, as well as some inspection tasks, could also be combined. It may be possible to focus personnel on defined areas of the municipality, for which they would perform most tasks related to data collection and inspection. Several possibilities exist to centralize data management, ranging from partial centralized control over data collection, to complete central control over data collection as well as maintenance. The latter, especially, would require major organizational changes.

7. Conclusions

This chapter serves as the conclusion of this thesis, and it is here that the main research question will be answered:

To what extent are the BAG and BGT key registers compatible with their intended usage, and to what extent does this compatibility influence the spatial data administration of the municipality of Zwolle?

As far as the compatibility of the BAG and BGT key registers is concerned, the answer is that the two registers appear to be sufficiently compatible for use at a municipality. The main cause for concern between BAG and BGT has always been the geometric difference: top-down building geometry present in the BAG register, ground-level building geometry present in the BGT register. These two versions of a single building's geometry are difficult to reconcile, and appear to be contrary to the goals of both the network of key registers, as well as the broader NUP e-government program that includes the registers. The network of key registers demands clarity on the position of any key register in relation to the others, as well as clarity on the contents of the registers (Ministry of VROM, 2009a). The NUP program calls for efficiency (e-Overheid, 2008). Furthermore, the decision to include top-down building geometry in the BAG register does not appear to be driven primarily by user demand (Krijtenburg, Smit, Van der Lely).

However, this lack of compatibility between the registers appears to be less of a problem than it may seem, and for several reasons. First, the two types of geometry are linked with each other. Since the key registers are object-oriented, the unique identifier of one type of geometry can be added as attribute data to the other, so it should always be clear which geometries belong together. Second, technical solutions can be used to strengthen this link, for example by keeping both databases synchronized (Van der Lely). Thirdly, as Ellenkamp mentioned, a surveying team sent out to map a building's geometry can survey both geometries at the same time. A similar fourth point is that municipalities may well store both types of geometry in a single database, further diminishing the divide between BAG and BGT geometry (Ellenkamp, Krijtenburg). Fifthly, since municipalities have just created the BAG building map, it is expected that many will simply copy this data into the BGT register, since the vast majority of buildings does not have sufficiently different top-down and ground level geometries (Krijtenburg; Ministry of VROM, 2008a).

The above are methods through which the compatibility between BAG and BGT can be increased. The necessity for increasing the level of compatibility lies with the design of the registers, however. While VROM does appear to be working increasing key register compatibility (Ellenkamp), a greater effect may be caused by the mandatory nature of the key registers, which forces public organizations, as well as their private sector suppliers, to adopt solutions to the incompatibility problem themselves, solutions that appear to be fairly effective.

More difficult is the issue of the compatibility between the WOZ and BAG key registers. The surveyed municipalities are largely in agreement that the level of compatibility is currently too low. Two major causes mentioned are the lack of geometry in the WOZ register, and a fundamental difference in definition between a WOZ-object and a BAG-object. The former is defined functionally, by its owner/user, the other spatially, by the structural borders of a building or occupancy unit. This difference causes difficulties when performing spatial analysis on the data. Municipalities can already use WOZ-subobjects to create their WOZ-objects, since these subobjects contain only a single BAG- or BRK-object. This solution is only possible for municipalities using their own WOZ-data, however. Since the main WOZ key register does not use WOZ-subobjects, any other institution will not be able to treat WOZ-objects as spatial data. Still, municipalities should strive to use WOZ-subobjects where possible, to allow for easier links between BAG and WOZ data, as well as easier spatial analysis of WOZ data.

The compatibility issue is not the only way in which BAG and BGT impact municipalities, however. The adoption of the key registers also brings challenges and opportunities to municipalities, as well as other organizations that will implement them. Multiple ways can be identified in which the arrival of the network of key registers in general, and specifically the BAG and BGT registers, may impact municipalities in the future.

First of all, data used for the maintenance of public space (BOR) could be integrated with the future BGT register, possibly as optional data. Efforts are being made to create strong links between roads in the BGT register, and road segments in municipal BOR databases (Krijtenburg). Integration of these two spatial databases could further streamline municipal spatial data administration, by removing double storage of data, as well as creating a stronger link between municipal BOR data and the municipal topographic base map, which in the future will be the BGT register. Some of the eight questioned municipalities have integrated these two databases, or have plans to do so.

Second, there appears to be a trend among municipalities to streamline municipal data administration. Centralization of data administration at a municipality can take various forms. First, it can include centralized control over data collection, in which a central municipal department can task data collectors from other departments, for example surveyors, to collect additional data at the same location for another department. Second, it can include directly centralized data collection. Surveyors and other municipal personnel tasked with the collection of certain data now belong to a single central department, responsible for collecting all municipal data. Thirdly, it can include completely centralized collection, storage, and maintenance of municipal data. Not only is the collection of data centralized, but the central department also stores and maintains all municipal data.

Centralization of data collection, storage, and maintenance can already be observed in the suggestions given above: the integration of BOR data with the BGT register (or any other municipal base map), as well as a combined BAG/BGT topographic database such as Ellenkamp and Krijtenburg mention. Many of the eight questioned municipalities have, or have plans for, some form of centralized municipal data management.

A third issue that is affected by the introduction of the BAG and BGT key registers is the collection of spatial data. While the current topographic base map at Zwolle and other municipalities is often created using terrestrial surveying, the BAG key register's building map is often created using aerial photography. The reason for this is that top-down geometry for all buildings in the municipality was required, and this data was not yet available. Aerial photography covers large areas quickly at a relatively low cost per object. However, for permanent maintenance of a topographic map, aerial photography has some downsides. One problem is that aerial photographs are not generally made of the same area more than once or twice per year, and are usually only made in the spring and summer months. This can cause problems with the temporal quality of the data, since GBKN (and future BGT) rules state that certain topography should not be more than six months out of date. However, aerial photography can easily be used to map objects that are not accessible from the ground, perhaps because they are located on private premises, and are invisible from any road. Generally, while aerial photography keeps improving as a cartographic method, terrestrial surveying may still be necessary for some topography in the near future, mainly core urban areas. Rural areas and large building or infrastructural projects, however, can already be easily mapped using aerial photography. The responses from questioned municipalities largely confirmed this trend: more intensive use of aerial photography, but not as the sole method of topographic data collection.

Finally, one other item to consider regarding the spatial key registers is the division of the maintenance of BGT data. There are various 'sourceholder' organizations that each maintain (parts of) datasets that will form the BGT key register. The vast majority of future BGT data will be maintained by municipalities, however, which prompts some to call for the municipality as the sole BGT sourceholder (Van der Lely). One possibility could be that the other sourceholders – other levels of government, water boards, ProRail and Rijkswaterstaat – send their data to municipalities, who then maintain their part of the BGT for all objects in their jurisdiction. This way, less problems may occur where the data from the different sourceholders conflicts. Surveyed municipalities were in disagreement over what the ideal BGT-sourceholder arrangement should be. However, without changing the current sourceholder arrangement, municipalities could still attempt to cooperate with other sourceholders on those object classes that are often maintained multiple times. Trees are one possible example. However, this cooperation should be voluntary and based on local possibilities, since there are also many municipalities and other sourceholders that do not maintain additional, non-BGT spatial data (plusinformation).

The introduction of the BAG and BGT key registers will definitely cause changes in the administration of municipal spatial data. While some of these changes are mandated by law, like the collection of top-down building geometry, others are simply possibilities worth investigating. These possibilities touch on the integration of BOR and BGT data, data collection methods, centralization of municipal data collection and maintenance, and the division of BGT sourceholder data. Meanwhile, the existing incompatibility between the BAG and BGT key registers appears to be only a minor problem, since there are various organizational and technical solutions that municipalities can employ to minimize its negative effects. In short, the following recommendations can be made:

- Municipalities should investigate all possibilities of further integrating BAG and BGT building geometry. This includes the creation of a list of all buildings for which two different geometric shapes will have to be kept, examining methods of keeping the two geometric shapes synchronized, mapping both geometric shapes simultaneously, and storing topographic BAG and BGT data in a single database.
- Municipalities should also look into increasing the compatibility between municipal BAG and BGT registers. WOZ-subobjects should be used wherever possible, since they can be easily linked to BAG. Adding geometry to municipal WOZ-objects is another possibility that may make it easier to perform spatial analysis on WOZ data.

- Municipalities may want to evaluate their spatial data administration practices. There are possibilities to centralize data management, as well as alter the current mix of methods used for spatial data collection. Topography can be increasingly mapped using aerial photography, although terrestrial surveying will remain useful in some areas.
- The Ministry of VROM should continue their efforts to increase compatibility between all key registers, the spatial key registers in particular. The link between BAG and the spatial components of WOZ, requires particular attention. Cooperation between the different responsible ministries is necessary for this, as well as for the compatibility among the entire network of twelve key registers.
- It is recommended that the main points in this thesis are evaluated at a later date. Some time after the BGT key register is completed would be an ideal moment. Municipalities can then be asked if the compatibility problems between BAG and BGT persist, or indeed if they have been diminished due to the various solutions outlined here. Large-scale quantitative analysis among municipalities may yield very useful information.

Following the recommendations above, the BGT key register can hopefully increase the value and use of topographic data in the Netherlands, through the removal of redundant data administration and the standardization of its content. However, the success of the BGT register also relies on all sourceholders to supply high quality data to it about the physical landscape of the Netherlands. It relies on users to provide feedback, it relies on the Ministry of VROM to manage the design and guide the implementation along. All parties involved need to cooperate in order for the BGT key register to provide the entire public sector with the information they need.

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Appendix A: Answers to municipal questionnaire

1. Functie van de antwoordende persoon							
<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
Sectiehoofd Informatie-voorziening	Landmeetkundig Coördinator	Hoofd Afdeling Geo-informatie	Senior Medewerker Geo-informatie	Senior Adviseur Informatie-management	Teamleider Informatie-management	Teammanager Geo-informatie	Senior Medewerker Geo-informatie
2. Zijn, bij uw gemeente, de datasets voor gemeentelijke BOR-taken als groen-, wegen-, en rioolbeheer geïntegreerd in de gemeentelijke GBKN-basiskaart?							
<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
In Breda hebben wij de TKB (Topografische Kaart Breda). Eigenlijk een foute benaming omdat het TBB (Topografisch Bestand Breda) zou moeten zijn. We spreken in de huidige tijd immers niet meer van kaarten, maar van bestanden. In Breda zijn dit type objecten gedeeltelijk geïntegreerd in de TKB. Dit vanuit het project Taal van de Stad. Daartoe hebben we de stad opgedeeld in	Nee, momenteel worden deze apart beheerd, waarbij gebruik wordt gemaakt van de GBK	In Groningen hebben we al 10 jaar geleden de afspraak gemaakt dat de geometrie van de beheerobjecten voor groen en wegen tot op het beheerniveau beheerd wordt door Geo-Informatie in het objectgerichte grootschalige basisbestand (GBBG). De beheerafdeling, verantwoordelijk voor het BOR, voegt in hun procesapplicatie de administratieve	Nog niet. We staan de komende maand voor een pakketkeuze m.b.t. BOR. Eén van de uitgangspunten zal worden dat de geometrische componenten opgeslagen worden in de centrale geografische database.	Het team Geo-informatie verstrekt op dit moment nog de Grootschalige Basiskaart Helmond onder meer aan de diverse beheerdisciplines Openbare Ruimte die op basis hiervan in aanvullende lagen gedetailleerdere beheervlakken toevoegen. Het beheer van de GBKH wordt uitgevoerd mbv dg DIALOG Topografie. De GBKH bevat nu	Per 15 april zou dit moeten werken. We zijn bezig een geodatabase in te richten met alle beheer openbare ruimte gegevens, wegen, groen en riool, de kadastrale kaart en de gbko (Oldenzaal) We gaan ook in de geodatabase de gbko en de pandenkaart geïntegreerd bijhouden. Dit met behulp van de Grontmij module.	Nee. Wel is de GBKT (Tilburg is een zelfmutterende gemeente) uitgebreid met plus topografie. Beter gezegd: Wij houden een objectgericht bestand (spatial database) bij waaruit we de GBKN generen voor levering. Echter, de geometrie betreffende groen, grijs en blauw is niet gekoppeld aan de GBKT. Hier vindt ook een dubbele bijhouding plaats!	Nee, de digitale kaarten hiervoor worden in aparte beheer-applicaties bijgehouden. Voor raadpleegdoeleinden worden zowel GBKN als (o.a.) beheer-kaarten wel in één Oracle-spatial database ingelezen.

gebiedscategorieën zoals woongebied, bedrijventerrein etc. Een woongebied bestaat weer uit bouwstenen zoals een winkelstraat, een woonstraat, stadshart over erftoegangsweg. Een bouwsteen is opgebouwd uit elementen zoals de toegestane soort open, dan wel gesloten verharding etc. In de TKB is zoveel aangesloten tot op het niveau van de bouwstenen. Er is dus sprake van partiële integratie van topografie en beheerobjecten.		gegevens toe.		reeds (in objectvorm en in 1 database) de verschijningsvorm volgens de BAG en de verschijningsvorm volgens de GBKN-Zuid.		Dit wordt echter door zowel Geo Informatie als de verantwoordelijke voor de BOR-taken onderkent. Op dit moment start een project om een centraal (geo) database van alle binnen de gemeente Tilburg gebruikte geometrieën in te richten waarbij de koppeling gewaarborgd is. Integratie komt er op korte termijn dus aan.	
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3. Is uw gemeente voor of tegen een uitgebreide BGT, waar bijvoorbeeld ook wegvakken en groendata in zijn opgenomen? Om welke redenen?

<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
De BGT staat voor Basisregistratie Grootschalige Topografie. Strikt in de geest van de definitie basisregistratie betekent dat het opbouwen van een	Hierover is nog besluit genomen. De specs van de BGT zijn ook nog niet definitief	Gelet op de toelichting bij vraag 2 zijn we voorstander van een uitgebreide BGT. Met name de standaardisatie volgens IMGeo kan op deze manier tot	Persoonlijk maakt mij dit niet zoveel uit. Organisatorisch gaan we het straks zo inkleden zoals hier boven omschreven, één	Het team Geo-informatie is op dit moment bezig om alle geometrische wegbeheergegevens volgens het Imgeo model te integreren in de GBKH. Eenzelfde	Wij zijn voor deze uitgebreide BGT omdat dit dan een standaard vormt voor alle gemeenten en deze hun beheer openbare ruimten objecten	Voor onze interne bedrijfsvoering ben ik voor een uitgebreide BGT. Beter gezegd in het kader van het antwoord op vraag 2: Ik ben voor een uitgebreide geo-	Het is wel een soort "ideaal"-plaatje, maar het lijkt ons op korte termijn vanuit beheer-oogpunt geen haalbare situatie.

<p>minimale set topografische gegevens, vanwaar anders de naam. Op de zuivere betekenis komt dat type data dus niet voor in de BGT.</p> <p>Vanuit de ambitie om bij te dragen aan een integrale en adaptieve bedrijfsvoering streven wij naar een uitgebreide BGT. Integrale inwinning ten behoeve van meerdere processen draagt daar aan bij. In dat opzicht willen wij geen gescheiden processen. Dat zou ondoelmatig zijn. TKB-data en data voor het beheer van de openbare ruimte worden zoveel mogelijk integraal ingewonnen. Wij hebben daarin het optimum nog niet bereikt. Er is nog winst te boeken in de samenwerking met andere partijen. Zo hebben wij met</p>		<p>veel efficiency leiden.</p>	<p>centrale geografische database. Hierin zal uiteindelijk toch meer beheerd worden dan landelijk geleverd moet worden. Middels een filter op deze database regelen we dit dan. Wanneer blijkt dat hier landelijk behoefte aan is (door meerdere partijen gebruikt) dan moeten we dit uiteraard wel gaan opnemen in de BGT.</p>	<p>actie zal volgen voor de objecten Groen en Water. Hierbij zullen de laatste detailleringen vwb de objecten vermoedelijk bij de disciplines blijven gezien de daar aanwezige kennis en kunde. Wij zijn dus voorstander om centraal alle geometrie (tbv objectvorming) voor alle gemeentelijke werkprocessen in te winnen en te beheren. Onze organisatie is op dit moment echter nog niet zover, laat staan om alle data tbv alle werkprocessen centraal te verzamelen.</p>	<p>op elkaar zijn afgestemd. De openbare ruimten van de BAG worden op deze manier toch door geometrie voorgesteld.</p>	<p>database. Hieruit willen we de BGT kunnen genereren. De BGT op zich hoeft geen uitgebreid bestand te zijn maar moet juist een terdege basis vormen voor de diverse afnemers. Een overkill aan data (lees inhoud) zal averechts werken.</p>	
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<p>Brabant Water een overeenkomst voor levering van de geometrie van de brandkranen. Integraliteit was overigens ook de reden om het "civiele" deel van geo-informatie (rooilijnen, assen van wegen, hoogtemeting etc.) samen te voegen met areaal-beheer van de directie Buitenruimte.</p>							
<p>4. Zijn er plannen binnen uw gemeente voor een vorm van centraal gemeentelijk gegevensbeheer, en zo ja, zijn deze plannen opgesteld naar aanleiding van de invoering van de basisregistraties?</p>							
<p><u>Breda</u></p>	<p><u>Deventer</u></p>	<p><u>Groningen</u></p>	<p><u>Hardenberg</u></p>	<p><u>Helmond</u></p>	<p><u>Oldenzaal</u></p>	<p><u>Tilburg</u></p>	<p><u>Utrecht</u></p>
<p>Er zijn geen vastomlijnde plannen voor het inrichten van een afdeling voor centraal gemeentelijk gegevensbeheer. We hebben wél een onderscheid aangebracht in productie en beheer. Bedrijfsspecifieke data worden beheerd in de lijn.</p>	<p>Ja, maar moet nog uitgewerkt worden.</p>	<p>Er zijn nog geen concrete plannen. Het zal zeker onderwerp van gesprek worden binnen de gemeente om het beheer van ruimtelijke data centraal te beheren.</p>	<p>Zoals reeds gemeld, centraal beheer van de geografische gegevens.</p>	<p>De gemeente Helmond is bezig met de opzet en inrichting van een Gegevensmakelaar . Deze makelaar is zowel een techniek (applicatie en database) voor het gecontroleerd uitwisselen van basisgegevens en een persoon die afnemers en bronnen bij elkaar brengt en</p>	<p>Ja, zoals ik al heb aangegeven wordt er binnen het team informatie-management gewerkt aan de geodatabase waarin alle geometrie en daaraan gerelateerde administratie worden vastgelegd.</p>	<p>Zie antwoord op vraag 2. Deze ambitie komt niet voor uit de basisregistraties. Zoals uit de antwoorden hierboven blijkt zijn de basisregistraties een extractie uit onze gegevensset.</p>	<p>Ja, het streven is om het beheer van alle basisregistraties bij 1 dienst onder te brengen. Dit is niet direct het gevolg van de invoering van basisregistraties, maar het maakt het praten hierover wel makkelijker en duidelijker.</p>

<p>De productie van basisgegevens wordt zo dicht mogelijk bij de bron belegd. Binnen SSC-IV-MO (waarvan ik hoofd ben) is een team Gegevensmanagement operationeel. Zij zijn verantwoordelijk voor datamodellering, beveiliging, autorisatie, integratie en distributie (binnen- en buitengemeentelijk). Tussen Gegevensmanagement en de lijn (voor bijvoorbeeld de TKB) is sprake van een opdrachtgever-opdrachtnemer-verhouding. Voor de BAG en de WOZ hebben we onlangs een afdeling Registratie en Beheer ingericht. Mijn persoonlijke voorkeur gaat uit naar een gemeenschappelijke gegevens-</p>				<p>afspraken maakt over welke gegevens met welke kwaliteit worden afgenomen en verstrekt. De Gegevensmakelaar is gepositioneerd bij het team Geoinformatie. Hier ligt ook het bronhouderschap van de gegevensverzamelingen BAG en BGT. Op dit moment zijn wij bezig met het opstellen van een beheernotitie waarin we voorstellen doen betreffende al dan niet verdere centralisatie van het beheer van administratieve en geometrische basisgegevens.</p>			
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voorziening. Maar dat zeg ik als persoon en niet vanuit gemeentelijk beleid. Ik denk dat de noodzaak om een GGv steeds manifester wordt.							
5. Vindt u dat de samenhang tussen BAG, BGT en de andere basisregistraties voldoende is voor gemeentelijk gebruik? (bijv. afstemming panden tussen BAG, BGT en WOZ)							
<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
Als het gaat om meta-toepassingen (ruimtelijk ontwerp) wel. Als het gaat om registratieve doelen vaak niet. Wanneer de juiste plus-informatie wordt toegevoegd neemt de gebruikswaarde van de combinatie onevenredig meer toe. Een ander punt is dat er in mijn optiek sprake is van verticale organisatie van data binnen de mono-cultuur van een autonome opdrachtgever dan wel afdeling. Iedere basisregistratie kent zijn eigen inwinningsproces en	Ja, volgens mij wel	Gelukkig houdt de inrichting van de BGT rekening met de definiering van objecten in de BAG. Daar zit wel samenhang. Bij de WOZ is dat lastiger, omdat een WOZ-object en een verblijfsobject binnen de BAG per definitie iets anders zijn.	Er ligt nagenoeg geen relatie tussen de BAG en WOZ. De WOZ wordt op kadastraal perceel niveau beheerd, de BAG op pandgeometrie. Wil je echt integreren dan moet zo snel mogelijk de kadastrale relatie over boord bij de WOZ en moet er op het kleinste objecten niveau beheerd worden. Dit is in dit geval het deelobjectenniv	Op dit moment is er vanuit VROM onvoldoende samenhang gebracht tussen de diverse projecten zoals BAG, BGT en WOZ, maar heeft men wel de intentie om die samenhang te realiseren en neemt VROM ook initiatieven om koppelingen zoals BGT-BAG, BAG-WOZ generiek te definiëren zodat gemeenten en softwareleveranciers hierop een daadwerkelijke koppeling kunnen realiseren.	Dit volgt niet uit de basisregistraties. Zo vind ik het niet goed dat we binnen de BAG alleen aan een punt binnen het vlak gegevens koppelen en niet aan het vlak. Daarnaast loopt de basisregistratie woz nog niet echt. Ik vind het ook een gemis dat de geometrie van het wozobject niet binnen de basisregistratie is opgenomen. Als in alle drie	Ja en nee: De relatie tussen de panden vanuit de BAG en BGT is vreemd (dit geef je in je rapport ook al aan). Vanuit de WOZ is er geen wettelijke verplichting tot opname van geometrie. Binnen de gemeente Tilburg ontbreekt dan ook een WOZ-objectenkaart. Hierdoor is afstemming moeilijker. Op dit moment wordt er in Tilburg gewerkt om de organisatie van de basisregistraties	Er valt nog wel wat te verbeteren. Zo zouden de WOZ-objecten nog meer geïntegreerd kunnen worden met de BAG-objecten, waardoor bv. panden zonder verblijfsobject beter traceerbaar zijn. Als de gemeentelijke basisbestanden het volledige RSGB-model omvatten wordt de samenhang wel veel beter, maar dit omvat meer dan alleen de basisregistraties. De afstemming

<p>zijn eigen beheeromgeving. Ik licht het altijd toe met het volgende voorbeeld; ik heb maar één sofi-nummer een daar hangt alles aan wat van mij bekend moet zijn bij de fiscus, rijksdienst wegverkeer etc. Een gebouw kent er meerdere. Het is dus telkens zoeken naar het verband daartussen.</p>			<p>eau van de WOZ. Afstemming tussen BAG en BGT voor wat betreft de panden valt op dit moment mee te leven. Wel jammer dat dit verschillend afgebeeld wordt, maar technisch is dit in de centrale database te regelen.</p>	<p>Helmond participeert in het landelijke samenhang programma en koppelingsprojecten. Met onze visie over integrale gegevens-huishouding en de inzet van de Gegevensmakelaarden denken wij de samenhang te kunnen realiseren.</p>	<p>basisregistratie de geometrie als basis wordt gebruikt kan hiermee door middel van bestaande gis tools een schat aan meerwaarde ontstaan. Dit betekent dat binnen de BGT men tot een goede afweging moet komen in hoeverre men gedetailleerd wil zijn. Als openbare ruimten van de BAG door BGT geometrisch ingevuld kan worden zullen de wegvakken, groenvakken de grenzen aangeven van de openbare ruimten. Hierin kan een uitdaging zitten voor de BGT.</p>	<p>op orde te krijgen. Hiermee bedoel ik niet de registraties op zich maar de organisatie en afstemming. Het zijn nu nog losstaande registraties, onder gebracht bij verschillende afdelingen/teams. Er dient een soort van overkoepelende verantwoordelijke eenheid te komen voor het complete stelsel van basisregistraties.</p>	<p>tussen onze huidige topografie en de BAG is niet altijd optimaal omdat de definities niet gelijk zijn (bv. bovenaanzicht versus omtrek op maaiveld). In hoeverre dat straks ook voor de BGT gaat gelden is nog niet bekend.</p>
<p>6. Wat is uw visie op de organisatie van het BGT-bronhouderschap? Is de huidige situatie geschikt? Zou de gemeente wellicht zelf de enige bronhouder moeten zijn? Moet de gemeente een verzamelpunt worden van de data van andere bronhouders binnen uw gemeente? Of heeft u nog andere ideeën hierover?</p>							
<p><u>Breda</u></p>	<p><u>Deventer</u></p>	<p><u>Groningen</u></p>	<p><u>Hardenberg</u></p>	<p><u>Helmond</u></p>	<p><u>Oldenzaal</u></p>	<p><u>Tilburg</u></p>	<p><u>Utrecht</u></p>

<p>-De BAG kent slechts één bronhouder. Hetzelfde geldt voor de WOZ, Personen, Kentekens, BRT en Percelen. Voor de BGT kennen we er meerdere. In mijn optiek is er maar één bronhouder: de gemeente. De overige partijen zijn bronleverancier. Bij nadere beschouwing is dat een groot verschil vanuit de context NORA 3.0.</p> <p>-De huidige situatie is niet geschikt. We hebben verschillende typen gemeenten (Topografie Producerende Gemeenten (TGP), Zelfmutterende gemeenten (ZMG), zelfregistrerende gemeenten (ZRG) en afnemende gemeenten (AG). Hetzelfde geldt voor een aantal bronleveranciers al zijn daar de benamingen iets</p>	<p>Gemeente als bronhouder, omdat zij de grootste afnemer is</p>	<p>Het zou in mijn ogen een uitgangspunt moeten zijn om de gemeente het bronhouderschap te verlenen voor de totale BGT. De gemeente kan dan ook de data afkomstig van de provincie, waterschappen, RWS en Prorail inpassen in het totale bestand en aanbieden aan de landelijke voorziening. De gemeente heeft dan altijd een totaal actueel bestand.</p>	<p>Wij zijn een zelfmutterende gemeente en ervaren dat dit het meest efficiënt werkt. Huidige situatie overleind houden dus. De gemeente beheert het hele gebied en wordt v.w.b. de 5% voorzien van gegevens door derden (provincie, waterschappen enz...) Deze organisaties zullen ook wel weer meer bijhouden dan in de BGT is vereist. Dus zullen een eigen(plus) bestand beheren. Wil je het echt efficiënt dan <u>alle</u> geografische gegevens laten beheren door de grootste partij (gemeente). Dit zal wellicht een stap te ver zijn.</p>	<p>Wij zijn voorstander van korte en simpele (koppelings)lijnen. Wij hebben er geen probleem mee indien de diverse topografie producerende instanties zoals Rijkswaterstaat, Prorail, Gemeenten, Waterschappen en Provincies ieder voor zich en ten aanzien van het gebied waar zij verantwoordelijk voor zijn de topografie levert aan de Landelijke Voorziening. Uiteraard overeenkomstig de afgesproken kwaliteitsnormen. Alle afnemers zoals de gemeenten moeten vervolgens in staat zijn om de bij andere bronhouders opgetreden mutaties (gebiedsoverstijgend) gratis van de</p>	<p>Het BGT bronhouderschap zit goed bij de gemeenten, zij zijn het gewend en kunnen dit aan. De gemeenten die niet zelfregistrerend zijn kunnen met elkaar tot uitbesteding overgaan. Hierover zijn al ideeën geventileerd tijdens de bijeenkomst BGT in Almere.</p>	<p>Afgelopen week (24 maart) heb ik een bijeenkomst vanuit BROM bijgewoond. Het betrof hier de klankbordgroep voor de bestuurlijke organisatie. Met name het bronhouderschap kwam hier aan de orde. Zoals je vraagt "is de huidige situatie geschikt?" klopt dus niet helemaal aangezien we vier verschillende mogelijkheden hebben besproken. Wat uit dit overleg sowieso naar voren kwam is dat de gemeenten bronhouder worden voor in ieder geval de 95% van het gebied. Dus wat dat betreft klopt je vraag weer. Mijn antwoord luidt nee: De gemeente moeten</p>	<p>De gemeente zou de bronhouder moeten zijn over het gehele gebied binnen de gemeentegrens. Wel moeten er dan juridische afspraken gemaakt worden met leveranciers van brondata aan de gemeentes, een gemeente moet namelijk wel kunnen beschikken over de juiste gegevens, ook al heeft hij geen directe toegang daartoe. Op deze wijze kan de gemeente ook goed omgaan met de objectvorming binnen de BGT. Daarnaast zou dit parallel blijven lopen met de BAG waarbij ook de gemeente bronhouder is voor haar hele gebied.</p>
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<p>anders. Wat mij betreft gaan we naar één type gemeente: DE GEMEENTE, naar één type provincie: DE PROVINCIE etc.</p> <p>-Dat hangt af van het type gemeente. Hoewel we allemaal gemeente zijn vullen we de verantwoordelijkheden verschillend in. Een TPG doet dat anders dan een afnemende gemeente. Vanuit de verantwoordelijkheid is de gemeente verzamelpunt en integreert de aangeleverde data van de andere bronleveranciers. De dat worden opgeslagen in een database van bijvoorbeeld het Gemeentelijk Samenwerkings Verband. Het GSV verzorgt de distributie naar de LV BGT.</p>			<p>In ieder geval <u>niet</u> afstappen van huidige werkwijze door bronhouderschap bij meerdere partijen neer te leggen. Is technisch op dit moment ook nog een brug te ver wil je het in 2011 operationeel hebben.</p>	<p>LV af te nemen. Met betrekking tot dit onderwerp is door Dataland het idee geopperd om als tussenlaag een Gemeentelijk Samenwerkings Verband (GSV) in te richten die de bestanden van de verschillende bronhouders integreert en communiceert met de LV. Hieruit zou dan volgens Dataland, als een eventueel groeipad, ook een voorziening gebouwd kunnen worden om de door u geschetste plusgegevens (bomen, verkeersborden, ...) centraal te verzamelen en te distribueren.</p>		<p>zeker geen bronhouder worden van alle data. Je hebt immers te maken met snelwegen (Rijkswaterstaat), het spoor (ProRail), Militaire terreinen (Defensie) en nog enkele bronhouders. Het landmeten op snelwegen, spoor en op militaire terreinen is niet zo eenvoudig te organiseren. Je krijgt te maken met veiligheid, toegang, etc. Daarnaast hebben partijen als RWS, Prorail en Defensie al veel langer een goed registratiesysteem. Aansluiting hierop via een landelijke voorziening is raadzamer. Het is ook niet van belang wie hier bronhouder is. Een belangrijker punt wat goed</p>	
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						georganiseerd moet worden is de aansluiting van de grenzen van de verschillende bronhouders op elkaar! Ook daar hebben we het 24 maart over gehad. Dat vergt nog wel de nodige afstemming en organisatie!	
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7. Wat zijn in uw gemeente de meest gebruikte vormen van inwinning van geografische data, voor het bijhouden van de gemeentelijke basiskaart, BOR-data, en andere doelen? Gebeurt dit bijvoorbeeld via luchtfoto's, terrestrische inwinning mbv landmeters, of opname van matenplannen? Waarom wordt deze vorm van inwinning het meest gebruikt?

<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
Inwinningsmethoden: terrestrisch (tachymetrisch, GPS) en m.b.v. 3D-summit en stereo10-beelden. Ook worden data opgeleverd vanuit de projecten. Voorbeeld: een revisiemeting maakt deel uit van bij een wegreconstructie en vallen buiten het reguliere inwinningsproces. In mijn visie worden matenplannen in de	De inwinning van de GBK gebeurt indien mogelijk dmv luchtfoto's obv de kwaliteitseisen van de stichting GBK en het merendeel wordt terrestrisch ingewonnen. De terrestrische inwinning wordt meestal toegepast, om aan de kwaliteitseisen te voldoen en om de levertijd (bv. nieuwbouwgebied en elke 3	Het is een mix van al deze vormen van inwinning. Voor een basisbestand geldt dat er veel gebruiksdoelen zijn. Gebruik t.b.v. ontwerp en besteksvoorbereiding eist een terrestrische nauwkeurigheid. Voor andere gebruiksdoelen gelden andere criteria. Tot nu toe geldt in Groningen dat terrestrische nauwkeurigheid	Alle genoemde vormen worden gebruikt. Afhankelijk van wat het meest efficiënt werkt wordt dit toegepast. We zien dus een verschuiving van minder terrestrisch naar meer luchtfoto en plantopografie.	Omdat de op- en inrichting van een Mutatie Registratie Centrum (MRC) in de jaren 1998-1999 niet lukte, is er voor gekozen om periodiek (2x per jaar) middels terrestrische metingen de mutaties ter plaatse aangetroffen mutaties te meten. Dit wordt via aanbesteding in de markt gerealiseerd. De inhoud van de	Terrestrische metingen Luchtfoto's 360 graden foto's De gemeente Oldenzaal heeft en landmeter die m.b.v. tachymeter en GPS wijzigingen inmeet . Indien de nauwkeurigheid het toelaat meten we ook uit luchtfoto's.	Wij meten vrijwel alles terrestrisch in. Waar onze landmeters geen toegang hebben kan besloten worden om dit middels lufo's te karteren. De plantopografie t.b.v. de BAG wordt uit de bouwtekeningen gehaald.	De gemeentelijke basiskaart wordt bijgehouden door middel van terrestrische inwinning door "eigen" landmeetploegen. Reden hiervoor is de gewenste nauwkeurigheid in het cyclisch proces waarin Landmeten zich begeeft. Zij zetten uit, meten in en de data wordt verder gebruikt voor beheer en

toekomst ook een bron voor het volledig maken van de bestanden. Maar zover zijn wij nog niet. Terrestrische inwinning is nog steeds de meest gangbare. Dat heeft te maken met de generatie landmeters, gewortelde gewoonten enerzijds en de (tot nu toe) gewenste nauwkeurigheid anderzijds.	maanden) Vanuit het matenplan wordt geen info in de GBK geplaatst.	geldt voor objecten in of aan de openbare ruimte v.w.b. de gebouwen en verharding. Daarnaast wordt veel fotogrammetrie gebruikt voor mutatieverwerking .		BGKH is door de gebruikers bepaald en dit wordt periodiek herhaald. Wel wordt in 2010 een systeem geïmplementeerd om mbv luchtfoto's eventueel te kunnen karteren. Dit kunnen dan mutaties in buitengebieden betreffen of BAG panden op niet toegankelijke terreinen of andere projectgegevens.			uiteindelijk weer voor vernieuwend ontwerp. Doordat Landmeten bij alle processen betrokken is kunnen zij ook efficiënt te werk gaan. De inwinning van gegevens voor de BAG in de achterbebouwing zal zeer waarschijnlijk uit luchtfotogrammetrie gaan gebeuren. Dit vanwege het kostenaspect en doorlooptijd. Bij de inwinning voor de BGT worden extra objecten meegenomen voor de BOR.
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8. Zijn er nog andere zaken die u kwijt wilt rond de invoering van BAG en BGT, het bronhouderschap, inwinning van ruimtelijke data, de stroomlijning van gemeentelijke gegevens binnen uw gemeente, of heeft u nog andere opmerkingen bij dit verslag?

<u>Breda</u>	<u>Deventer</u>	<u>Groningen</u>	<u>Hardenberg</u>	<u>Helmond</u>	<u>Oldenzaal</u>	<u>Tilburg</u>	<u>Utrecht</u>
	Mbt de BGT zijn wij in de beginfase	Het is duidelijk dat de komst van de BGT als een enorme kans gezien moet worden om de inwinning, beheer		Er komen vanuit de rijksoverheid vele initiatieven en wetgeving op de gemeenten af. Denk hierbij aan het Nationaal		Heb je in de laatste Geo Info het artikel gelezen van Bart vd Lely (Grontmij)? Dit artikel beschrijft ook waar wij naar	

		<p>en distributie van ruimtelijke gegevens goed te regelen binnen de gemeente. Ik kan me ook voorstellen dat het voor gemeenten als een groot probleem wordt gezien. Het is daarom belangrijk elkaar te zoeken in deze ontwikkeling en waar mogelijk samen op te trekken door samenwerking e.d.</p>		<p>Uitvoerings Programma (NUP). Een aantal projecten zoals BAG en Wabo hebben bovendien een grote impact en moeten worden uitgevoerd door een beperkt aantal (geo)-deskundigen. We constateren dat zowel ten aanzien van wetgeving en planning de diverse initiatieven te weinig op elkaar zijn afgestemd met als gevolg stress bij de gemeente als uitvoerder van de landelijke plannen. Wenselijk is ook dat de diverse projecten een gelijke invoeringsstrategie krijgen. Goed voorbeeld is het BAG project waarbij vanuit een centrale regie contactgroepen worden aangestuurd.</p>		<p>toe willen. Een geïntegreerd product voor zowel de BGT als BOR. Bart focust erg op de BGT terwijl wij focussen op onze geo-database waaruit zoets als de BGT gegenereerd kan worden. De BGT is voor ons geen product op zich. Daarnaast staat in Geo Info (9, 2009- jaargang 6) een artikel over Tilburg waar een collega en ik aan hebben meegewerkt. Dit kan je een beeld geven van onze organisatie.</p>	
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