Digitalisation and new technologies within spatial data in relation to key registers topography, addresses / buildings and 3D cadastre.

Dorus KRUSE, The Netherlands

Key words: Cadastre; Cartography; Digital cadastre; e-Governance; Geoinformation/GI; GIM; GSDI; Spatial planning; Standards

SUMMARY

In The Netherlands there are 10 key registries, the Netherlands' Cadastre, Land Registry and Mapping Agency (in short Kadaster) is the source holder for two of them and is for three other key registries responsible for integrating the data into one registry as there are multiple source holders. The key registries in the Netherlands make it possible to improve the efficiency of the Dutch government and enable implementing the 'only once' principle (EU e-government objective).

In this paper we discuss how new technologies have improved these key registers, making them more cost effective, more usable, sharing them with more users and helping to solve the major issues in The Netherlands.

Examples to be explained in the paper: Creating the key register Topography from other key registers (using large scale data, key register Addresses and Buildings), developing a 3D key register. Improving the key register Addresses and Building with a new viewer and API, ranking this key register as the most valuable in The Netherlands. Working on a 3D Cadastre to improve the quality and process when registrating apartments and shared spaces within buildings.

Further more this paper will also address the usage of the new standards of OGC that has helped to improve findability of the data, searchability of the data and an increase of usage of the data by different kinds of users.

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1. THE KEY REGISTERS IN THE NETHERLANDS

In the Netherlands a system of key registers has been set up. There are 10 key registries, which together form a digital network of key information that is important for the digital government in The Netherlands. While some of the key registries are not open to all users, most key registries are open registries and contain data that can also be used for commercial purposes. The 10 key registries are:

- Key registry Addresses and Buildings
- Key registry Large Scale Topography
- Key registry Income
- Key registry Cadastre
- Key registry Subsurface
- Key registry Persons
- Key registry Topography
- Key registry Vehicles
- Key registry Real Estate Valuation
- Key registry Businesses

The Netherlands' Cadastre, Land Registry and Mapping Agency (in short Kadaster) is the source holder for two key registries of them; key registry Cadastre and key registry Topography. For three other key registries, Kadaster is responsible for integrating the data into one registry as there are multiple source holders. These are key registry Addresses and Buildings, key registry Large Scale Topography and key registry Real Estate Valuation. By integrating the data into one key registry the accessibility for government and companies is improved as they do not have to acquire the data from all source holders (in some cases hundreds of municipalities in the Netherlands), but can get the data from one source.

The key registries in The Netherlands make it possible to improve the efficiency of the Dutch government and enable implementing the 'only once' principle (EU e-government objective). For the key registries to serve as the single source of information a high data quality is very important. Therefore multiple measures are in place to ensure that source holders provide information of high quality and find out which part of their dataset might be improved.
The key registers are government registers of authoritative data which are mandatory to use by all public institutions in fulfilling their public tasks. This system of key registers operates on the principle “only once”, so collect “data once, use it many times”. This reduces the administrative burdens for citizens and businesses and at the same time quality improvements

and cost savings for the government itself are realized. Figure 1 shows the system of key registers and the links between the different registers.

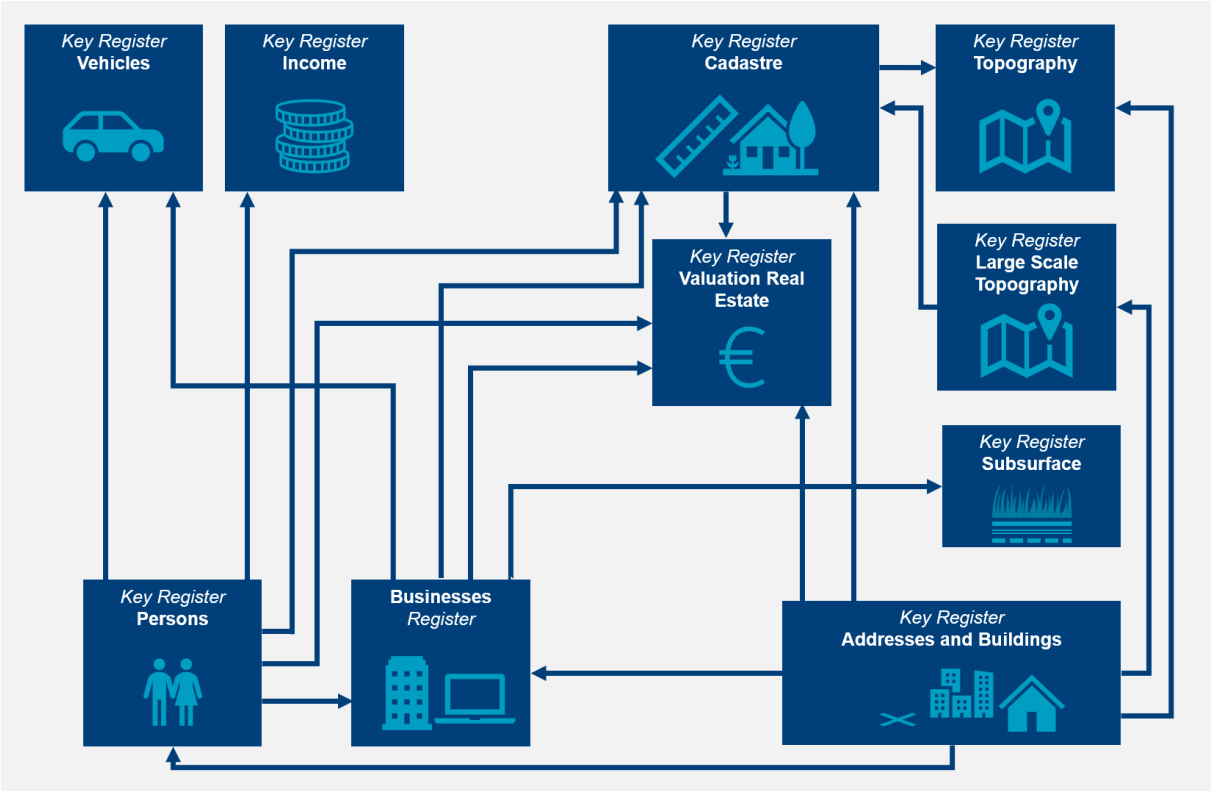

Figure 1: System of key registers in The Netherlands.

2. NEW TECHNOLOGIES TO IMPROVE KEY REGISTERS

The world is constantly changing, therefore key registers need to change as well to maintain data quality on a sufficient level and to fit the purpose of the users that is also changing. This is not an easy task and a continuous effort and needs innovative technologies. The Dutch Cadastre has worked on a couple of new technologies, innovative adaptions to the already existing key registers.

2.1 Improving the key register Addresses and Building with a new viewer and API

The key register Addresses and Buildings (BAG) is a successful dataset, combining geo-location and administrative references. BAG-data supply started in 2011, and has now over 3,5 billion requests in a year and the usage is growing. Success came through user influence, a well rated viewer and a quality focus. But improvement is needed to address the growing use

and to facilitate government agencies and companies to easier solve social issues with geo-data, ranging from real estate and healthcare to energy and infrastructure.

The Key register Addresses and Buildings (Basisregistratie Adressen en Gebouwen, BAG) is the authentic dataset with all addresses and builidngs in the Netherlands. The BAG contains data like year of construction, surface, purpose and location on the map. People, companies and applications use the BAG more and more. Municipalities are responsible for capturing and maintaining the data in the BAG including the quality. All municipalities provide the data to the Central facility. The Cadastre, Land Registry and Mapping Agency of the Netherlands maintains the central facility and provides the data to the various users.

The usage has increased to over 3.5 billion requests a year from the central source alone.

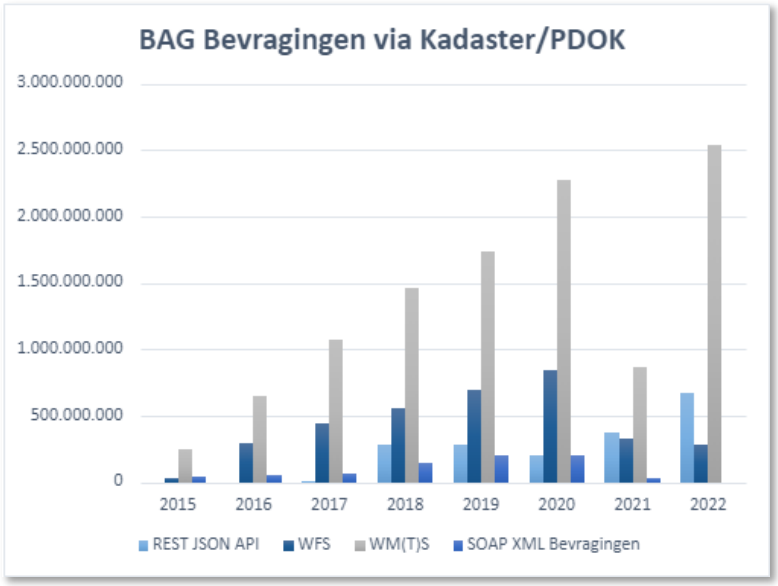

Figure 2: increase of usage of key register Buildings and Addresses.

2.1.1 New viewer and API

The BAG Viewer shows the BAG data, both administrative information and on the map. And it shows feedback signals from users. Since 2017 the user feedback loop can be started in the BAG Viewer. Giving feedback signals has become easy. This shows in the number of feedback signals. The feedback signals are visible for all users and they can follow the feedback loop. Municipalities use these signals to improve the BAG quality.

In 2023 the viewer had been renewed and has resulted in many positive responses. The new features in the viewer are:

- Ability to copy data of the screen and use immediately;
- Viewer is now moble friendly, has a responsive website;

- Historical data is added to buildings;
- Visualisation of the changes of the objects;
- Feedback through viewer has been made easier;
- Multiple layers according to experience of the user has been introduced, so easy access for all users.

The key registry Addresses and Buildings has also an improved API. This API (Application Programming Interface) makes it possible to have controlled access to BAG data. With this API a user can query the key register directly on a specific object. This results in an easy communication between differenet datasets. The improvements on the BAG API are specifically:

- Near real time actuality;
- Restful API in JSON format;
- API according the Open API Specifications (OAS).

2.2 New standards of OGC

The Open Geospatial Consortium (OGC) came with a new OGC API family of second-generation, internationally standardized service interfaces. These include services like OGC API Features, OGC API Coverages, OGC API Tiles and OGC API Records. These have been implemented at the Dutch NSDI called PDOK (Public Services on the Map). The results of the implementation of these new OGC API's are:

- Easier adoption non-geo experts;
- Findable and easy to share;
- Quick insight in usability;
- Mora usage leads to better quality.

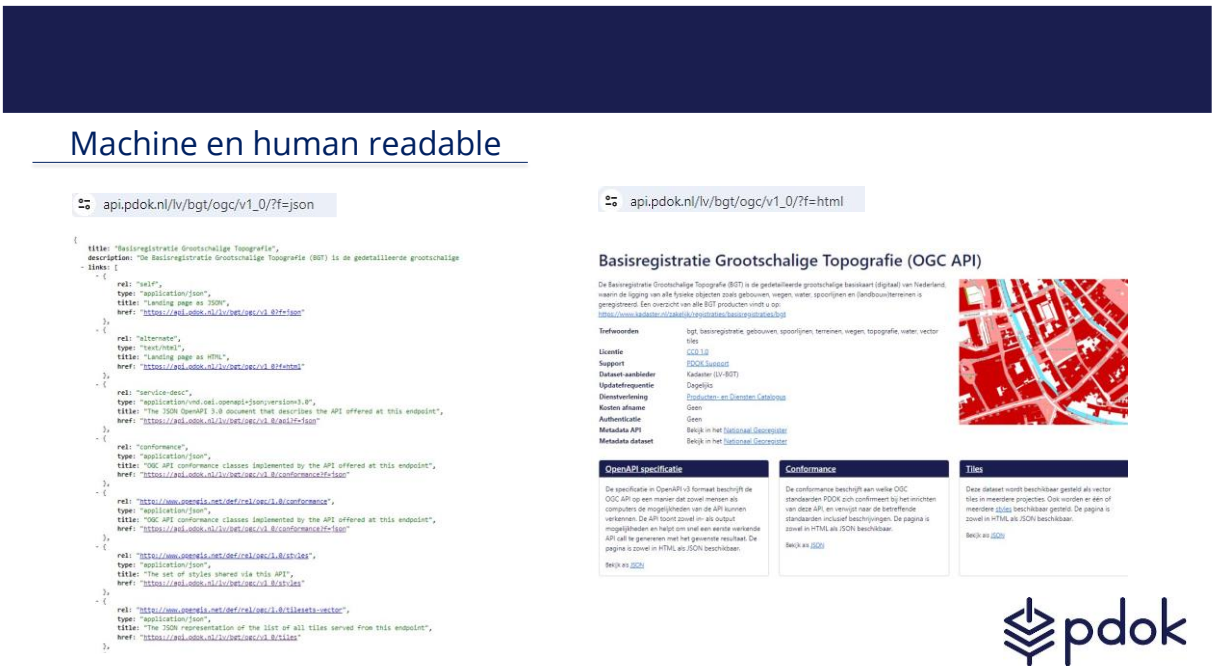

Figure 3: example on how easy the capabilities of the dataset can be read by machines and humans.

With the introduction of OGC API Tiles the Dutch NSDI has been able to cut costs of background maps by creating vector tiles of the background maps and is now able to support multiple map styles instead of 4 basic ones. With these vector tiles, users can create their own style and costly storage centrally is not needed anymore.

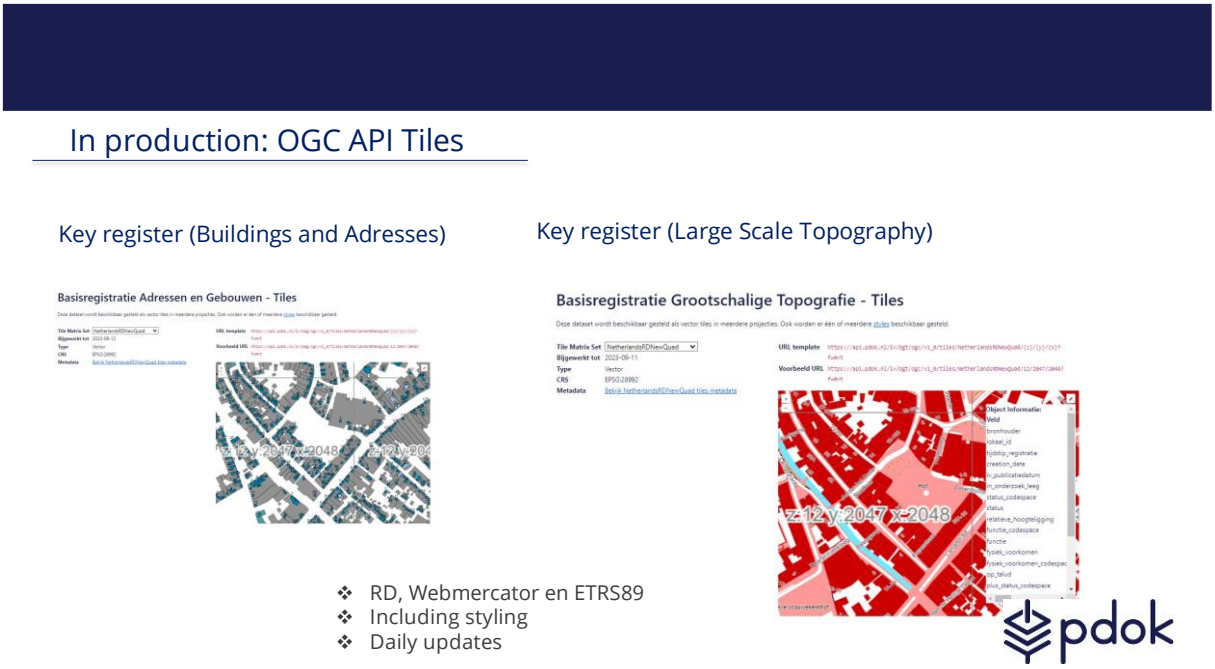

Figure 4: OGC API Tiles.

2.3 New technologies for the key register Topography

The key register Topography is updated yearly by the Dutch Cadastre. Because of the increasing quality of the key registers Addresses and Buildings and Large Scale Topography, a new production process has been designed to use as many data form the other key registers as possible to decrease the costs of the manually update process of the key register Topography. Figure 5 shows images of these three key registers.

Figure 5: Key Register Addresses and Buildings (BAG),. *Key Register Large Scale Topography* (BGT), *Key Register Topography* (BRT).

Key Register Addresses and Buildings (BAG): Building and address data. Unique objects with address, area, contour and purpose. The data is produced and maintained by more than

300 municipalities. The register is updated by municipalities continuously. The Dutch Cadastre is register keeper and responsible for quality management.

Key Register Large Scale Topography (BGT): Large scale topographic data, scale 1:500 – 1:5000. The data is produced and maintained by more than 350 local, regional and national authorities. The register is updated by producers continuously. The Dutch Cadastre is register keeper and a partner in quality management.

Key Register Topography (BRT): Small scale topographic data and maps, scales 1:10.000 – 1:1.000.000 produced and maintained by the Dutch Cadastre. Fully updated yearly in 5 releases with uniform quality. The Dutch Cadastre is producer, register keeper and responsible for quality management.

The key register Topography in a 1:10.000 scale will be used to automatically generalize small scales (1:25.000, 1:50.000, 1:100.000, 1:250.000, 1:500.000 and 1:1.000.000).

2.4 Developing a 3D key register.

Although the number of use cases that require a 3D register still has to increase, we already see usage of the 3D datasets (for example Digital Twins). Technology, software is more and more available. The Dutch Cadastre had developed a dataset on Topography that was available as a download. Now it is working on making this data better accessable, easier findable and will use the Dutch NSDI PDOK as a platform for this. The landing page of PDOK will contain latest news on 3D, will host the latest products in 3D and users will be able to give feedback on the 3D data on this platform. The community activities and visualisation of the 3D data can be found on PDOK. Also the new 3D viewer. So on this 3D page at this platform you can find:

- Basic 3D viewer;
- OGC API for 3D Tiles;
- 3D Tiles (OGC standaard).

The software that has been used for the 3D viewer is Cesium JS framework.

Figure 6: 3D Buildings in 3D viewer.

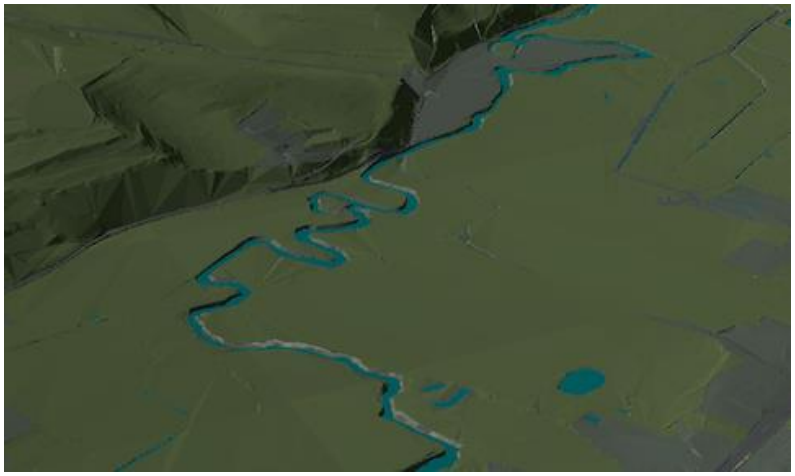

Figure 7: 3D Terrains in 3D viewer

2.5 Working on a 3D Cadastre.

The real estate market is changing. More and more apartment building for instance have shared spaces that are difficult to visualise in a 2D model. Especially high rise buildings can be make more clear in a 3D view and 3D Cadastre. This requires a digital transformation of the registry. A Cadastre registry that is future proof, so:

- Easy to understand;
- Prepared for complex buildings;
- Able to register planned sales till the actual finish of the transaction;
- Sustainable & circulair.

The Dutch Cadastre is working on a 3D Cadastre that is not only availbale as a 3D view/map but also legally in 3D. The results will be:

- Easy and fast insight in legal en actual situation;
- Closer coöperation wit the Real Estate Agencies and Building companies;
- Creates insight in objects, rights, materials adn helps sustainability.

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BIOGRAPHICAL NOTES

Dorus Kruse is a senior manager at the Netherlands' Cadastre Land Registry and Mapping Agency (Kadaster) with over fifteen years of professional experience in project management and five years as Geo manager. He has worked for the Dutch Tax Office for more than ten years as an IT consultant and IT project manager. For Kadaster Dorus was project manager for the Topographical Key Registry and responsible for implementing NSDI web services. Dorus was involved with the innovative project of implementing a Government Geo portal. He was responsible for the programme Public Services on the Map (PDOK), as part of the Dutch spatial data infrastructure. He is currently responsible for the department where the functional maintenance of all applications of Kadaster Netherlands is in operation. For Kadaster International Dorus managed projects in Turkey, Croatia, Northern Macedonia, Serbia, Kosovo and Montenegro.

CONTACTS

Dorus Kruse
Cadastre Land Registry and Mapping Agency
Hofstraat 110, 7311 KZ
Apeldoorn
THE NETHERLANDS
+31652481987
Dorus.Kruse@kadaster.nl
www.kadaster.nl