Measuring with the Map, Building the future of Field Surveying

Tom WORTEL and Tom VENHORST, The Netherlands

Key words: Cadastre; Digital cadastre; Education; Land management; Professional practice; Young surveyor

1. SUMMARY

For years, the Dutch Cadastre has maintained its unique position in The Netherlands by training and employing the largest amount of surveyors in the country, whilst also developing the software to do so with a large IT department. This model has come under pressure by all kinds of internal and external factors:

- In all associated fields, the Dutch labour market experiences large shortages in qualified personnel.
- Surveyors experience problems in user friendliness of the software. The software could be more modern, and cater to end users with less thorough knowledge and experience in the surveying field.
- The architecture of the applications is old fashioned, and could use cloud, AI, information security and other trending topics more effectively. The understaffed IT department could use more focus at the same time.

These factors lead to a change in direction for the Dutch Cadastre; which activities we are currently doing ourselves, could be left to the (international) market, while we maintain our position bringing legal certainty to the Dutch society? How can we ensure our information remains safe, without dialling back user friendliness?

The course we set out is one where we leave all technical applications to the market, after which we obtain the information to be inserted in the Cadastral registry through API's. This model ensures user friendliness for the end user, effective quality control, information security of our main databases and more effective focus for our IT department. In this way we ensure the Dutch Cadastre remains reliable and future-proof. A sustainable land registry.

Measuring with the Map, Building the future of Field Surveying

Tom WORTEL and Tom VENHORST, The Netherlands

2. VISION AND PROCUREMENT

Each change starts with an idea. In the case of the Measuring with the Map, this is part of a larger change to optimize our processes as Cadaster. The general concepts behind this are the notion that we as Kadaster can not be a truly unique organization with unique requirements. Our technical processes at least must be somewhat comparable to other organizations that build or maintain some kind of geographical or topographical map. In this regard, it remains strange that we have to develop our own software to support the processes our surveyors follow through.

With this idea, we started to consult the market for surveying software. It became obvious that the suitable product that delivered all our wishes did not exist. We did not want to limit ourselves too much, as we also strive for a clean, simple architecture with a serious reduction of the amount of applications our surveyors have to use. In discussions with various market parties we adjusted our requirements so sufficient (combinations of) companies could put in an offer. We ended up easing off the criteria on the product being a standard product that has more than 10 organizations as customers already, whilst maintaining the criteria on functionality.

The selection process itself is somewhat special as well. We needed a party that could handle quick adaptations to software that was already complete out of the box. Adaptability is necessary because we need the product to dock onto our API-focused architecture. Besides that, we did not expect a product that was entirely complete already, so we accounted for a year of development. This led to the decision to incorporate a 2-week paid development period for the best 3 offers, in which progress could be demonstrated. The three parties received guidance by 3 colleagues who knew what we needed during this period.

The result of this way of procurement has been the selection of a product that is actually close to developing a software package from scratch by an efficient party. This is not entirely what we wanted, but in the end, it became obvious that we are more unique than we wish. There is no survey really comparable to a cadastral survey where we need to be able to reconstruct old measurements to stake out current boundaries in the field. We need to combine old (total station, tape measurements) with new GNSS technology to achieve this goal. No other governmental body in the Netherlands employes 300 surveyors like the Kadaster does.

The result of the procurement is the selection of Delfy for all technical tasks. These incorporate:

- Surveying itself
- Creating the fieldsketch (which has to be added to the “Relaas”
- Adjustment and testing of measurements (quality assurance)
- Creating a proposal to update boundaries
- All products above are to be included in the API call to update our databases

In summary, the main lessons to be shared on the procurement are:

1) Accept the fact a cadastre is a unique organization, off the shelf software is probably not the optimal solution.
2) Elaborate consultation of the market is vital for a successful tender process and delivers high quality solutions
3) Let market parties demonstrate their solutions but also proof they have development capabilities by applying a 2-week pressure cooker approach.

3. ARCHITECTURE

When designing the architecture for our future-proof environment, we had a couple of important principles to consider.

First of all, we need to take into account that we have an existing system for registration of deeds, KOERS. Besides, we have a spatial database containing all parcels, the BRK in the architecture below, which is connected to KOERS but also connected to various other systems for dashboarding, accounting, document management and other related tasks. When designing a new technical workflow for surveyors, we decided to leave a lot of this systems as is, and create a new API to be able to insert data into the BRK. In this way, we can revise the technical working environment without touching parts of the infrastructure that operate as we wish. This first principle can be summarized as: if it ain’t broke, don’t fix it.

A second factor is our own, complicated, IT environment that includes a great variety of security measures which limit flexibility of data handling when acting inside this environment. The configuration with the API allows the technical applications to operate outside this environment. This principle became known as: position the cadastral surveyor as external surveyor.

A third and last principle is a revision of the data architecture which is conceptually presented in figure 1.

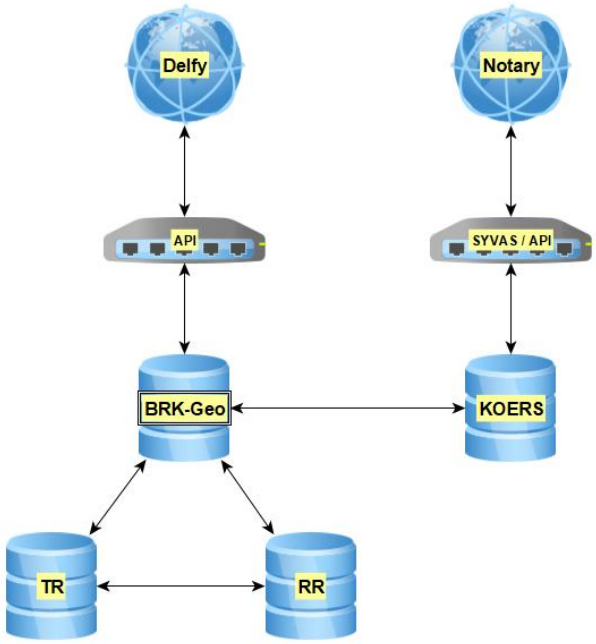

Figure 1. Conceptual presentation of the architecture

It should be both simple and connected, consisting of three databases which allow for simultaneous updating. The three databases are the following:

1) BRK-Geo containing the cadastral map
2) Terrestrial registration containing all measurements that have been done over the past 190 years
3) Relaas Registration containing all meta-information regarding the cadastral tasks, all financial, process, and legal information is stored here.

The databases are already partially there, but they can not be updated in one go. The API we introduce should fix it, by taking charge of the updating process of all three databases. This principle is known as the "big green switch" to update all data at once. The integration of updating services leads to less inconsistency between databases and faster update times. This does require one of the systems to take the lead in the updating procedures, in our case this is the BRK-Geo.

In summary, the architecture evolved around 3 principles:

1) *If it ain't broke, don't fix it*: Leave existing components as is if they function as intended
2) *Position cadastral surveyor as external surveyor*: Create a technical working environment detached from your own, secure, environment to allow flexibility in development and use of the software.

3) *Implement the big green switch*: Allow for simultaneous updating of related databases to ensure data consistency.

4. FUNCTIONALITY AND EDUCATION

The paper has focused on procurement and architecture, but of course the main goal of the project remains usability and completeness of the end product. The technical working environment must contain the tools to perform all the surveyors tasks, and offer them in a user friendly package.

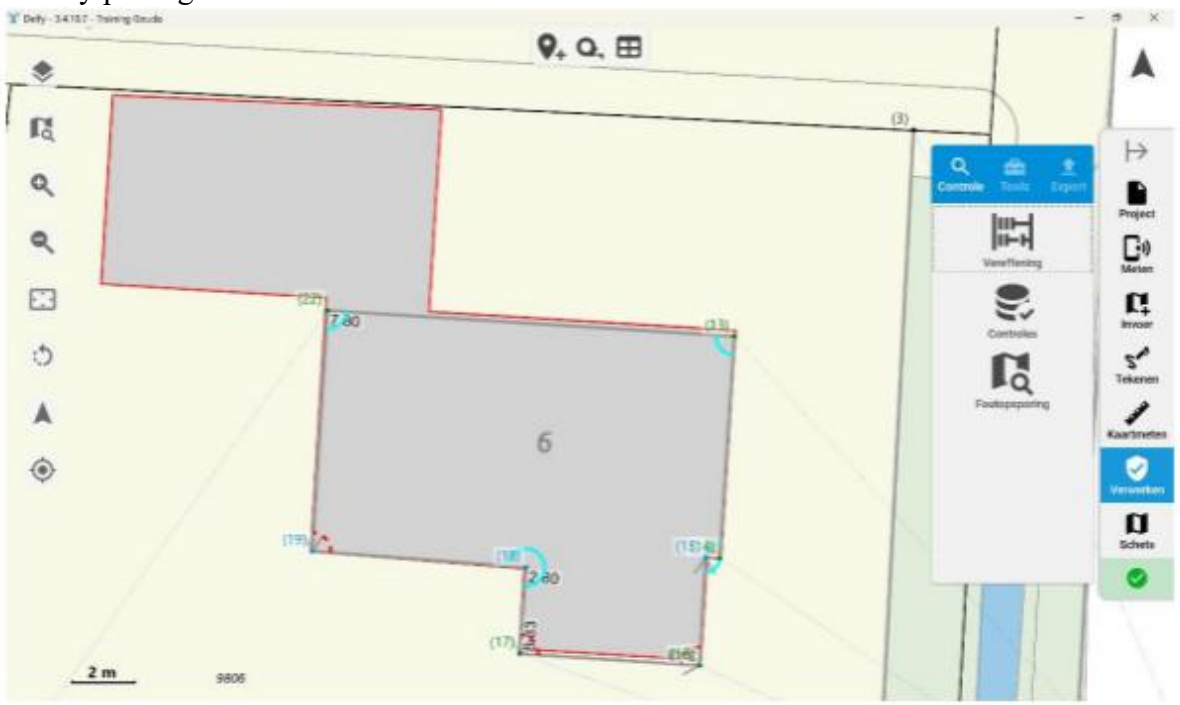

Figure 2: Measuring a building in Delfy. Note the green checkmark in the bottom right of the menu indicating all checks are successful at the moment

User friendliness is important not only for convenience of the surveyor, but especially because Kadaster trains its own surveyors. Therefore, we benefit from direct advantages if the software requires little training. In this regard, the choice for Delfy has proved to be a big success, as only 1 day of training is required to learn to use the software. After this day, the software helps the surveyor in different ways:

1) Real time quality control in stead of quality assurance after the survey has been completed.

Figure 3: Dozens of additional checks are at the surveyor's disposal

2) Automated sketching, where the field sketch is generated from the survey data as opposed to re-entering all data in a PDF editor.

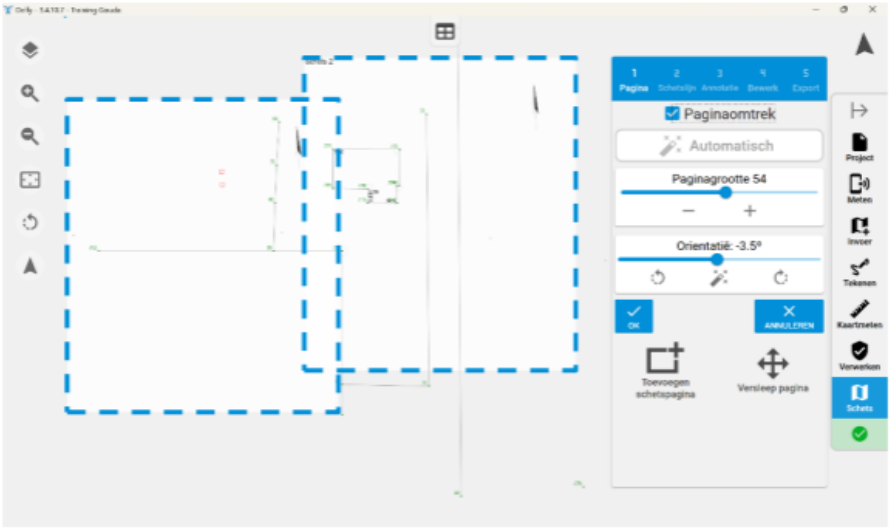

Figure 4: Generating sketches directly from the measurement data

3) Creating new boundaries directly from surveyed data rather than sketching the new boundary in KPV, a custom built WebGIS package based on imported survey data

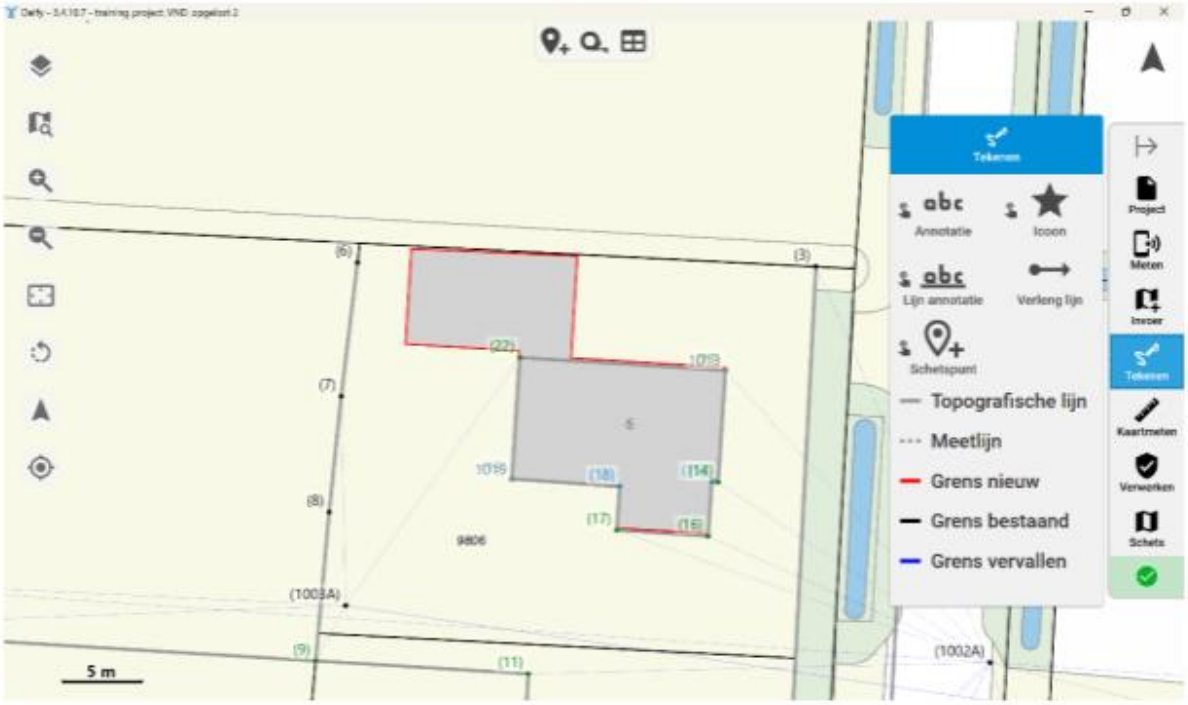

Figure 5: Sketching new boundaries based on survey data

Completeness of functionality is required to ensure a simple, maintainable software landscape but also contributes to user friendliness as the amount of import/export functions is limited as much as possible. The lack of interoperability of the applications we as Kadaster used before was one of the main concerns that led to the revision of the software in the first place. The new software replaces a total of 4 applications:

1) A dedicated Leica Captivate app designed for cadastral measurements
2) MOVE3 for QA/QC which is executed from the office
3) Bluebeam to create complete fieldsketch
4) KPV, for creating the new parcels based on the measurements

With the selection of Delfy as integrated working environment for all technical work, we can simplify our education and work process while still improving our data quality and minimizing data loss in transactions.

5. ROADMAP AND PROCEEDINGS

Delfy has been introduced as part of a roadmap consisting of further modernization of our applications. After this implementation, a couple of major projects deliver its results:

1) KKN (the new Cadastral Map). KKN creates a new, fully automated procedure to generate the map from measurements. In coming years, this map will become available using the measurements we have in our archives, dating all the way back to 1832. Once this project is completed, each new measurement will be processed automatically, which means no surveyor has to draw the actual border. Manual actions will be limited, room for error will be reduced even further.

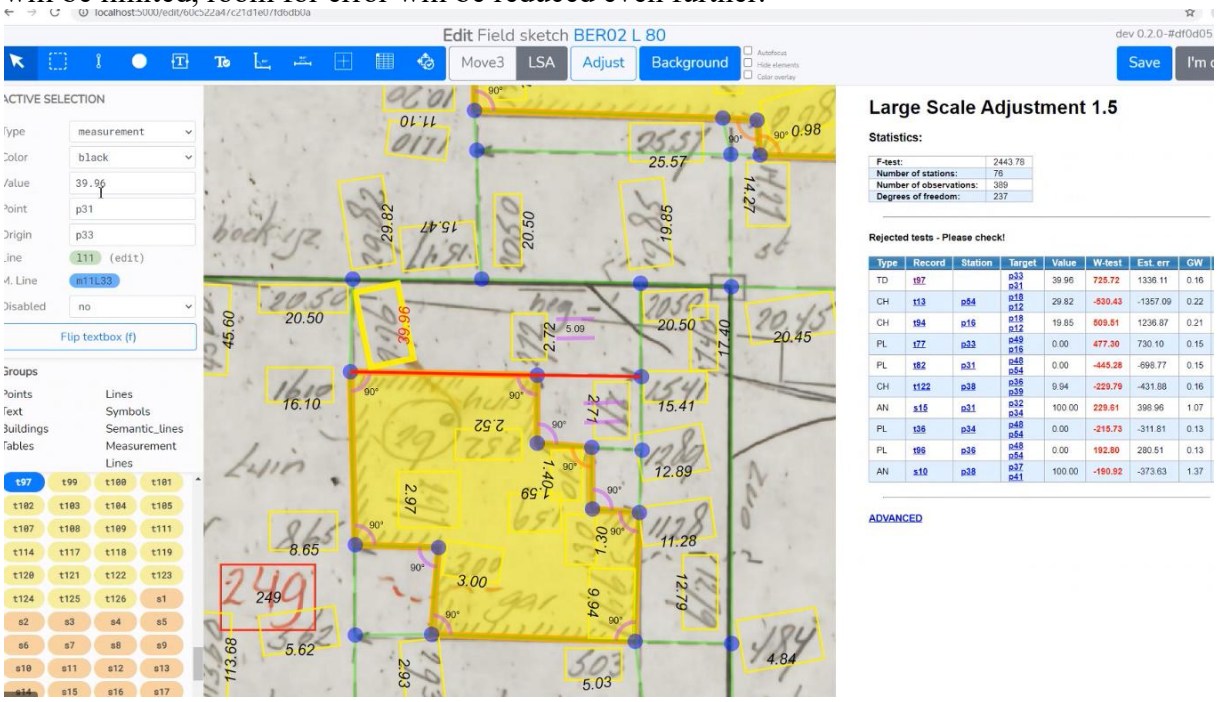

Figure 6: Kadastral Map Next: calculating the new map from measurements

2) New data environment. The three databases, BRK, TR and RR will become fully operational. After this milestone, a surveyor does not need to manually create a "*Relaas*" document anymore. A "*Relaas*" can be generated from data at any time using time stamps in eventsourcing databases. All administrative tasks will be limited to an absolute minimum.

3) Follow up measuring with the map projects will open up our API to surveyors employed outside of the Kadaster as well. Each certified surveyor will be able to update the Cadastral map. Firstly, specific contracted suppliers will start using these

interfaces. Later, a system of education and certification will be required to maximize benefit from this.

Extensive data modelling behind all these products ensures that the result of the projects will reinforce each other and all renewal will be streamlined.

6. CONCLUSIONS

Measuring with the map modernizes the way the Kadaster works in multiple ways. A new procurement process relying heavily on collaboration with market leaders, followed by an implementation of technical surveying software that allows for future innovation, simplifies processes, sets new standards for quality assurance and reduces complexity for end users marks a turning point in our history of creating our own software with a diverse and poorly maintainable software landscape as result. Integration in a broader roadmap with standardized canonical data models ensures longevity of the product, as well as maximizing potential gains of individual projects.

REFERENCES

BIOGRAPHICAL NOTES

CONTACTS

Ir Tom WORTEL
Kadaster
Hofstraat 110, 7311 KZ
Apeldoorn
THE NETHERLANDS
Tel. +31 6 50 16 04 79
Email: tom.wortel@kadaster.nl
Web site: www.kadaster.nl