3D Data Management – Relevance for a 3D Cadastre
Position Paper 3

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1. INTRODUCTION

This paper serves as a discussion basis for a working session on '3D data management' held as one of the four working sessions at the 4th International FIG Workshop on 3D Cadastre 2014.

2. CURRENT TRENDS ON 3D DATA

Looking back at the Workshop 3D Data Management in Delft 2011 (Streilein, 2011), there have been no major progress since that time in 3D data management and 3D analysis. The amount and use of three-dimensional data has continued to increase. We can still observe four major technology and business drivers for 3D.

1. There are massive new sensor hardware capabilities, such as automated data capture and model creation on the sensor side, LIDAR with masses of point clouds and automated photogrammetric workflows and processes.
2. 3D visualisation has now come into mainstream, but 3D analysis not. But there is as yet no mass market with consumer-focused systems.
3. Managing 3D data in enterprise workflows with improved performance and scalability of existing workflows and bridging the gap between point cloud surveys, GIS, CAD, BIM. Traditional file handling moves to database management.
4. There is a necessity for 3D data, where 2D data is not sufficient to describe our world and the consumer expectation demands three dimensions, as we all live and act in a three-dimensional environment.

3D data visualisation can be done by "everyone". However, 3D data management and analysis such as querying, manipulation, 3D map overlay, 3D buffering have been largely neglected in spatial database systems and Geographic Information Systems. Hence, current 3D data representations are quite suitable for visualization but rather inefficient for computation. In addition current 3D data models are often tailored to specific applications and simple 3D spatial objects only, resulting in a lack of ability of handling general and complex 3D spatial objects in a database context.

Mainly in English-speaking countries and in Scandinavia BIM are being captured. In other countries this kind of GIS application on a small scale is almost unknown. It would be a good additional argument for the establishment of a 3D cadastre.

For cadastral organizations, who traditionally describe their cadastral data in two dimensions and hold their information in 2D (often graphical) files, concepts for entering the third dimensions are not yet available, mainly due to the facts that,

- 3D modelling is much more heterogeneous and complex compared to 2D modelling;
- converting 2D data to 3D data on an operational level, with not just adding a Z-Coordinate onto each planimetric pair of coordinates, is quite cumbersome and there is no 'best' solution obvious, as the existing datasets are usually quite specific;
- one has to migrate from simple data structures to complex data structures;
- newly on has to deal with the economic and sustainability issues of handling and storing high data volumes compared to (relatively) low data volumes in the current years;
- and last but not least, user-friendly tools for 3D analysis are still missing.

Even though, that some specific actions have already been taken, such as the ISO 19152 Land Administration Domain Model (LADM) (Lemmen et al, 2010), that the new sensor technologies on the data collection side and that new 3D graphics hardware and powerful CPUs on the data visualisation side support the move to 3D; the main problem remains: 3D data management and 3D analysis is in a status where 2D GIS was a decade ago.

3. KEY ISSUES

For the establishment of a 3D cadastre there are several challenges and key issues to deal with. Some of them will be discussed and further elaborated during the working session on '3D data management'. There are still open questions to overcome such as:

- Is existing GIS software capable to handle the requirements of managing 3D data?
- What should be the main important developments of software manufactures in the near future?
- Where is still need of (scientific) research?
- There exists until today no mass market for 3D data management and 3D data analysis. Potential users don't know that they could solve their problems using 3D GIS and a 3D cadaster. How could we reach these future clients to stimulate the demand and thus indirectly accelerate the development of user friendly software?
- Identification of country specific similarities and differences (in the regions or in the world)

Several questions have to be posed and answered on a generic or operational level:

- What about data acquisition?
- Is crowd sourcing usable for 3D cadastre?
- What about automatic processes?
- What about software?
- What about data standards?
- What about system architectures?
- What are the types of 3D cadastral objects that need to be registered?
- What about the segmentation of objects? What about 3D data analysis?
- What about data presentation/visualisation?
- What about robust data management?
- What about temporal aspects?

4. POSSIBLE SOLUTIONS

3D is of relevance for the cadastre in future and the cadastre is not the main driving domain for the development of 3D data acquisition and 3D data management. There is a strong user demand that cadastral data can deal with 3D issues from data acquisition, through the processing, the storage, the data management and the representation of the data in an efficient and user-friendly way.

With this respect cadastre often faces similar problems as other application domains such as urban planning, soil engineering, mapping, aviation, transportation, land use planning, earth science and more. These domains have shown more and more interest in handling large data sets in 3D space from a data management perspective and we can learn from this. Not all problems will be solved by these domains because they are not dependent on exact defined point coordinates and topologically correct data as the cadastre domain is.

The challenge would be to identify the pros and cons of existing solutions, adopt them in a reasonable way, to identify research issues in a cross-domain approach and to define standards, which allow the efficient use of these data sets. But some problems have to be solved especially for the cadastre purpose.

REFERENCES

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BIOGRAPHICAL NOTES

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