Establishing a reference model for 3D geo-information in the Netherlands

E. Verbree, J. Stoter, S. Zlatanova, G. de Haan, M. Reuvers, G. Vosselman, J. Goos, L. van Berlo, R. Klooster

This paper presents the work in progress of a research project that aims at establishing a reference model for 3D geo-information in the Netherlands by extending existing 2D and 3D national and international standards.

The research project is initiated by four national organizations: Ministry of Housing, Spatial Planning and the Environment, the Kadaster (the Dutch national cadastre and mapping agency), Geonovum (the National Spatial Data Infrastructure executive committee in the Netherlands which develops and manages the geo-standards) and the Netherlands Geodetic Commission (co-ordinates and initiates fundamental and strategic research in geodesy and geo-information in the Netherlands). These four organizations observed that 3D information in the Netherlands is only used in specific applications and that there is a need for a uniform approach to advance in the domain of 3D applications. In addition the existing OGC standard for 3D models (CityGML) is rarely used. In the project a uniform approach for 3D geo-information modeling, exchange and use is empirically explored in collaboration with many stakeholders ultimately aiming at national agreements and standards.

The starting point for the 3D standard in our research project is the international 3D standard: CityGML. The suitability of CityGML is studied compatible to the national standards for 2D geo-information, other 3D standards and Building Information Models. In addition it is studied if CityGML extensions are needed to realize a generic national 3D standard-NL. These extensions may contribute to Application Domain Extensions (ADE) of CityGML in development, such as underground constructions, cables and pipelines and to integration with Building Information Models.

To meet the high ambitions of the project, i.e. to establish a national 3D standard, it was clear from the start that (many) suppliers and users of geo-data and geo-information as well as of 3D technologies should be involved. Therefore a call was launched in January 2010. About 90 people from about 45 organizations responded to the call. Most of the motivations that the respondents were asked to write, confirmed the observation that 3D geo-information is currently only used in ad hoc and specific applications. In addition many of the motivations expressed an urgent need for a uniform approach for 3D modeling.

To meet the aims of the project in collaboration with so many organizations and companies four activities were defined. These activities are executed in coherence with each other and jointly realize the objectives. The four activities are:
1. Identifying the availability of 3D geo-data and geo-information and sourcing test data as well as identifying best practices for 3D geo-information acquisition;
2. Investigating and defining 3D standard-NL;
3. Designing and implementing 3D testbed;
4. Specifying needs for 3D geo-information and technologies through use cases and evaluation of prototypes.
All the participants have subscribed for one of the four activities. This approach provides the possibility that all participants can work on their own expertise and interest while together realizing the aims of the 3D project.

Activity 1 ‘Supply of 3D geo-information’ works on the following research problems: How can 3D information compliant to the 3D reference model be generated from different data sources, such as point clouds and images from airborne and terrestrial sensors, 2D data from above and below the surface, and 3D models from the building domain (CAD/AEC/BIM/IFC)?

The main research question for Activity 2 ‘Investigating and defining 3D standard’ are: What will the standard for 3D geo-information-NL look like? Which concepts (objects and their properties) should be defined and how? How should geometry and topology be defined? What is the link with established 2D information models and with 3D models in other domains?

The main research questions of the 3D testbed activity are: How does the physical model for 3D geo-information look like and how can a CityGML file be converted to it? How can 3D geo-information be structured and managed in an integrated manner, as part of generic information flows? How to validate 3D information and data? How to update 3D information? How to interact with 3D geo-information stored in database or CityGML? What is the performance of 3D techniques?

Activity 4 ‘Realizing pilots via use cases’ concentrates on the following research question: Which applications ask for what type of 3D information (content, precision, geometry)?

The work on the different activities is running in parallel. One of the test areas where the use cases will be carried out is municipality Rotterdam, which is the owner of many different 3D data sets. 3D test data had been prepared for the test areas. Several of the Dutch 2D standards (Information models) are investigated and compared for the semantic and types of objects that they support to see how they fit in a 3D extension. In addition information models as IFC, BIM and CityGML are studied for possible integration. The pilot is currently entering the execution phase in which the use cases have become the engine behind the pilot. Execution of the use cases will be a collaboration of stakeholders within the use case, 3D data and 3D technology providers. The experiences of the use cases will be used to further develop the 3D standard-NL as well as to improve the 3D testbed.

The project will finish in spring 2011. Among the end results are: use case descriptions of a selection of 3D applications, publicly available test data for two test areas, an operational 3D testbed, demonstrators prototyping the selected use cases, recommendations for 3D geo-information use and 3D technologies as well as for further developing CityGML compatible with 3D standards in other domains and with established 2D information models. These results will be presented during a conference which will be open for everyone.

The experiences so far have shown the importance of studying the 3D standard from a dual perspective, i.e. from both the supply and demand perspective. At the one hand the 3D applications should be demand-driven to optimally meet user needs. At the other hand the users can better understand their needs if they know what kind of 3D data and technologies are available. This chicken-egg problem is explicitly addressed in the project. Suppliers and users of geo-information and the supporting technologies work closely together. Suppliers are provided with precise requirements of the users. At the same time growing awareness of available 3D geo-information and the supporting technologies may push the use of 3D information.