Chapter 6
Integration of Legal Aspects in 3D Cadastral Systems

Mohamed Sobaih Aly El-Mekawy
Stockholm University, Sweden

Jesper M. Paasch
Lantmäteriet, Sweden

Jenny Paulsson
KTH Royal Institute of Technology, Sweden

ABSTRACT

This article continues a research on the feasibility of BIM for 3D cadastre in unified building models, presented in El-Mekawy & Östman (2012). It describes problems and solutions concerning interaction between BIM and the registration and visualisation of legal 3D property information. BIM and legal 3D property are two seemingly different domains, and there is a lack of BIM-3D property research in relation to technical and registration issues. The article therefore focuses on possibilities and difficulties of addressing legal interests (i.e. rights, restrictions and responsibilities) in land. A Swedish case study is used to describe the use of 3D property formation and registration in Sweden, and how it might be possible to achieve a more integrated, standard based registration of legal boundaries and physical buildings. The results emphasize how BIM and 3D property domains can interact to serve the needs for effective information handling by e.g. importing 3D cadastral boundaries into BIM as basis for decision-making or to use BIM as input in the 3D cadastral formation process.

1. INTRODUCTION

The increased use of computer aided design (CAD) and building information modelling (BIM) has had a huge impact on the building industry in the recent decades and BIM has become a standard approach in large scale building projects worldwide (IAI, 2008-2014). To support this increased use of digital information in the building process different standards have been developed, such as CityGML and IFC. The building process is related to land use, which is increasing, especially in urban areas. The

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extended use of land, water and air has resulted in complex legal constellations of e.g. ownership and other rights. A tool to describe these rights, restrictions and responsibilities in a standardized framework is the international standard for land administration, the Land Administration Domain Model, LADM.

However, there has not been enough focus on how to implement the benefits of the increased modelling approach on the cadastral domain, which has very close relations to the building and construction domain by determining the legal boundaries and use of constructions. This issue was addressed by researchers in the last decades (e.g. Osskó, 2001; Sandberg, 2001) and still appears in recent studies (e.g. Ledoux & Meijers, 2011). Moreover, the use of models in the real property formation process and registration of real property information is not yet always a fully digital production line since analogue elements such as "printed maps and drawings" still may occur in the property formation process.

Although, the development of both domains, the construction modelling and the cadastral domain, has had unmatched speed, it is not seen only negative. Instead, it has caused a clear movement in research. A clear focus of research on cadastral issues and the need for the 3D cadastre was a driver for the first workshop of 3D cadastre in 2001. Three main topics were firstly defined as themes for 3D cadastre, namely 'legal', 'institutional' and 'technical' aspects. Among these three themes, the legal aspects were defined as the main key players of the design and requirements for developing real 3D cadastre information systems and applications. In addition to that, legal aspects received the highest initial support from the research community (Fendel, 2002). However, the focus of studies and projects in the last decade has been in contrast to what was aimed. The work has progressed more on developing prototypes of 3D cadastre system and data models resulting in the ISO standard 2012, whereas the non-technical areas of research (i.e. mostly the legal and organizational issues) have been receiving little attention (Paulsson & Paasch, 2011; Ho, Rajabifard, Stoter, & Kalantari, 2013). According to Paulsson & Paasch (2013) there is a need for more work on the legal aspects of 3D cadastre. Following their results on recent research, even though the focus on technical applications and solutions is apparent, there are still several legal aspects not solved or approached by these applications.

1.1. Purpose of the Study

The study illustrates and discusses proposals for how to represent real and complex 3D properties by the four surface types "Building Elements Surfaces", "Digging Surfaces", "Protecting Area Surfaces" and "Real Estate Boundary Surfaces" (El-Mekawy & Östman, 2012).

The aim is not to create a combined 3D property and BIM model or to implement the findings in existing or experimental 3D cadastral systems. The aim is to research how these domains can interact to serve the needs for effective information handling by e.g. importing 3D cadastral boundaries into BIM models as a basis for decision-making or to use BIM building models as input in the 3D cadastral formation process. Some of the areas to be researched are how to define and describe boundaries, investigate to which extent standards can be applied, describe 3D cadastral properties, etc.

An example of Swedish three-dimensional (3D) property formation is used as a case study to illustrate the current method of 3D property registration in Sweden, which is then used as basis for a discussion of how to apply CityGML and IFC standards to achieve a more integrated, standard-based registration of legal boundaries and physical buildings than possible today, at least in Sweden.

It is the intention that the research presented here can act as a theoretical framework and input to how to further an interaction of 3D legal real property concepts with the CityGML, IFC and LADM standards in the development of 3D cadastral systems.