Utilizing 3D Building and 3D Cadastre Geometries for Better Valuation of Existing Real Estate

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SUMMARY

Valuation of real estate/ properties is in many countries/ cities the basis for fair taxation. The value depends on many aspects, including the physical real world aspects (geometries, materials, and other aspects of quality or desirability) and legal/virtual aspects (rights, restrictions, responsibilities, zoning/development plans applicable to the objects spaces). Different countries make different trade-offs between efficiency, simplicity, and various aspects of perceived fairness. One aspect of perceived fairness may be that assessed tax be proportional to fair market value – except for a multitude of popular exceptions, such as farming or homestead exemptions. Another aspect may be for property tax to remain predictable over ownership of many years. One aspect is nearly always at the expense of another, and national systems can change, over time. The earlier analysis of the authors regarding the current valuation practices in various countries (i.e. Turkey, United Kingdom, USA, Germany, and The Netherlands) portrayed that property valuation and taxation is not currently significantly benefiting from digital 3D Building Models and 3D Cadastres. This is caused by low awareness regarding the possibilities provided by semantically rich 3D models and the availability of 3D models suitable for valuation. Although the 3D building geometries are not used today for valuation, they might well be used in the (near) future. While the highly detailed Building Information Models (BIMs) provide opportunities for model-driven valuation for the new construction projects, the utilization of CityGML 3D geometries give good opportunities for better valuation of existing buildings. 3D building models exist in a range of flavors: ranging from simply extruded footprint with height value to the earlier mentioned BIM/IFC models (including even materials and indoor geometries). Both extremes are not suitable as the extruded footprints are rather 2D geometries (with a height attribute) and do not show the added value of 3D geometries. The highly detailed BIM/IFC models could be used, showing the power of true 3D. These models, however, are only available for new buildings (and presently not even in all countries). Therefore we propose a 'middle' option of using a LoD2 digital CityGML model in derivation of valuation-related geometric / non geometric information. In many countries the valuation is based on parameters such as the total square meters or the total cubic meters. These parameters are often considered as simple alphanumeric attributes, which are somehow obtained or estimated. However, it would be more efficient to use actual square and cubic meters as these can be derived or at least checked automatically from the 3D building model geometries (i.e. from the building representation containing outer walls based on building footprint). By adding "streetview" images to the the 3D building models, these models will also give information about quality of the building and quality of the environment of the property, which is also of great importance for the valuation. Large quantities of building models are already available in the world, and it is expected that their number will continue to grow and they would become available as base information for cities and rural

areas. This information is also maintained well and can therefore serve a range of applications including the periodic mass appraisal for tax purposes. In addition to the models of physical objects, we also will further analyze the use of 3D legal objects; e.g. what are the legal boundaries of the property, or what is the allowed building volume/size. If this legal space of allowed construction is larger than the actual size of the building, this may have a (positive) effect on the market value. Furthermore other types of legal spaces related to RRRs (right = positive value, restriction = negative value, or responsibility) will be analyzed (e.g. restriction due to protected monument status, or due to a subsurface pipeline). 3D data sets are becoming increasingly available. This paper would focus on how 3D geometries in digital building models and cadastres may be utilized for fair and efficient computation of some key valuation factors, but also for presenting information to the appraiser for optimizing the appraisal model. Following the background on literature, the paper will concentrate on presenting the 3D geometry requirements for valuation and will then conclude by focusing on information transfer from 3D building models and 3D Cadastres (including spatial planning information and other RRRs) for valuation purposes.