A Taxonomy of Spatial Units in a Mixed 2D and 3D Cadastral Database

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SUMMARY

The aim of this paper is to define the range of objects that may need to be accommodated in the development of a practical cadastral database, to accommodate both 2D and 3D spatial units, and permit a range of quality of encoding to coexist. The level of geometric encoding as defined in the ISO19152 LADM provides a framework of categorisation of spatial units and a detailed range of coverage for registration, where spatial units are recorded in a cadastre, whether formal or informal, current or planned. The levels of encoding range from simple "text based" spatial unit - defined or partially defined by a textural description; to the "topology based" encoding. In practice it is not uncommon for the actual legal definition of the spatial unit to impose a restriction on the level of the encoding possible in the database. For example, a parcel may be defined as bounded on three sides by surveyed lines, but on the fourth by the bank of a river, which may erode or accrete with time. This could be seen as a mixture of text-based encoding with a stronger form such as line-based. In a cadastre containing 3D parcels, the level of encoding may not be the same in the X/Y dimensions as in the Z dimension. For example, a unit in a building may have its floor plan defined as a polygon with precise positioning, but the height extent may be described merely as "on floor 5". The existence of real-world examples of various combinations of 2D and 3D spatial units provide guidelines in the development of a 3D cadastral system. These include, amongst others, spatial units with: unspecified top / bottom (to/below the depth of …), horizontal planes defining top and bottom (a "slice"), faces restricted to horizontal or vertical, texturally described face(s), moving face(s) (ambulatory), non-planar (curved) faces, These are attributes of the "real world" spatial unit, but there are also issues that may become important by virtue of choices made in the database implementation, such as the presence of "caves", non-manifold boundaries and volumes with non-contiguous interiors (Ying, Guo et al. 2011). In developing any database, it is vital to have a complete picture of the range of possible objects that need to be modelled, if "surprises" are to be avoided in the implementation and acceptance testing. For example, the problematic cases identified in (van Oosterom, Quak et al. 2003). The first use is in the design process, to provide a checklist in monitoring the design for completeness. The second is in developing test data for the acceptance testing in the later phases of implementation. Different types of 3D parcels are much easier / harder to encode from source, and some jurisdictions have limitations on the types of 3D objects that can be registered. This paper also provides a background to determine what level of sophistication is needed in the data capture / update processes. It provides a discussion on the type of classification that is useful for a cadastral jurisdiction and the validation requirements of these classes of objects.