

# PART AND PARCEL OF CITY DEVELOPMENT

CITIES GROW BOTH VERTICALLY AND HORIZONTALLY. LAND REGISTRIES WILL NEED TO UPDATE TO THE THREE – AND FOURTH – DIMENSIONS. **PETER VAN OOSTEROM** LOOKS AT THE LATEST INNOVATIONS IN 3D CADASTRES

In recent years, 3D cadastre has matured. The increasing complexity of infrastructures and densely built-up areas require a proper registration of legal status (private and public), which can be provided only to a limited extent by the existing 2D cadastral registrations. Past FIG president Chryssy Potsiou commented: “No reality has a more direct bearing on the subject of three-dimensional geoinformation and cadastre than the growth of large cities, especially in the developing countries of the world, and especially in the phenomenon of the mega-cities.”

Addressing this challenge has been the main goal of the FIG’s joint commission three ‘Spatial Information Management’ and commission seven ‘Cadastral and Land Management’ working group on 3D cadastres. The FIG working group uses the concept of 3D cadastres with 3D parcels in the broadest possible sense: 3D parcels include land and water spaces, above and below the surface. The level of sophistication of a 3D cadastre in

a specific country will in the end be based on the users’ needs, land market requirements, legal framework and technical possibilities.

## The past and the future

FIG has been working with 3D cadastres since 2010. Registering 3D parcels has been an important step forward and is now possible in several countries. However, sharing, visualising and using these 3D parcels is another challenge. One example is the Delft Railway Area project in the Netherlands – a 3D map of the new building of a combined railway station and municipal offices was registered in 2016 for the first time ever in Dutch history.

The latest 3D cadastres developments were showcased at the 6th International FIG 3D Cadastres workshop in October last year. An excellent keynote was delivered by Rod Thompson: ‘3D cadastres: 30 years back, 30 years ahead’. Thompson took the audience back to 1988 when Queensland, Australia’s digital cadastral data base

(DCDB) was about half-complete and legislation supported the strata titles, while volumetric parcels were introduced a few years later. Among the big challenges were how to manage the administrative/legal and spatial data in an integrated manner and combine the different software development paradigms: object-oriented programming and relational database systems (as foundations of current systems).

Looking forward to 2048, the following easier predictions were sketched: blockchain and subsequent technologies will be subsumed into the distributed database, database schema will support full 4D (3D space and time), 3D cadastral spatial objects for airspace drones and flying cars, and complete rights, restrictions and responsibilities for the legal situation of land (including utilities, public rights and restrictions). In addition, Thompson also made some more controversial predictions, including an international cadastral database (complete coverage including oceans), lunar spatial units, Martian spatial units, and the use of quantum computing to blow away current encryption techniques.

An insightful paper by Agung Indrajit pointed out one general challenge: the need to integrate the rather different worlds of land administration (land registry and cadastres) and spatial planning (resulting in areas with legal implications), to get a more complete picture of all rights, restrictions and responsibilities in an area. For spatial planning and land administration,





Group picture of the FIG workshop on 3D cadastre

the need for 3D representations in our dense urban environment is crucial for sustainable spatial development. It is therefore suggested that the revision of ISO 19152, the land administration domain model, should include a new package on spatial planning information.

### Further maturing of 3D cadastres

Cities grow vertically as well as horizontally, thereby introducing the element of the third dimension. Recent innovative thinking has introduced the concept of a multi-dimensional multipurpose land information system. It is a logical extension of the 3D cadastres concept to add the time dimension and the detail/scale dimension to the equation. In a discussion of cost-effectiveness, one must consider time – that fourth dimension that we speak of. In time, we are usually referring to land titles history and time-sharing rights, or how the shape and size of land parcels and cadastral objects change over time, but it is also a matter of time-cost in the construction of the cadastre, as well as the time/property value relationship. As the great cities of the world become mega, the value of land and its improvements grow as well. Thus, the time/value relationship and its impact on land administration become central elements, and the need for continuing

research on fundamental policy issues of technical administrative, legal and financial aspects of land administration will grow.

The ongoing process of improving land administration systems is crucial. It responds to the need for international research in building effective land administration infrastructures with modern information technology that will support the 2030 global policy goals for sustainable development.

Some of the challenges where 3D cadastres may make a difference in the future are:

- The emerging mega-cities due to further urbanisation
- Marine cadastres
- Deep integration of 3D space and time (4D cadastre)
- New data acquisition techniques (including VGI)
- Growing information infrastructure (of which land administration is a part)
- New visualisation and dissemination techniques (including VR and AR).

2018 was an excellent year for the development and usage of 3D cadastres, but we will see many more developments in the next couple of years. To tackle these challenges, the FIG working group on 3D will continue.

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## BEST PRACTICES 3D CADASTRES

Some years ago, the FIG working group saw the need for a collection of best practices and a bigger focus on 3D cadastre. After several years of preparation and collegial teamwork, the FIG publication Best Practices 3D Cadastres has been published in extended (250 pages) and shorter versions (80 pages). The extended book provides a clear and comprehensive overview to both newcomers and experts in the 3D cadastre community. To further stimulate the sharing of 3D cadastre knowledge, the shorter version gives a summary of each of the five central areas. This FIG publication marks a milestone in the maturing of the 3D cadastre.

This FIG publication collects the best-known practices related to 3D cadastres and organises them into five chapters:

1. Legal foundations
2. Initial registration of 3D parcels
3. 3D cadastral information modelling
4. 3D spatial DBMS for 3D cadastres
5. Visualisation and new opportunities

