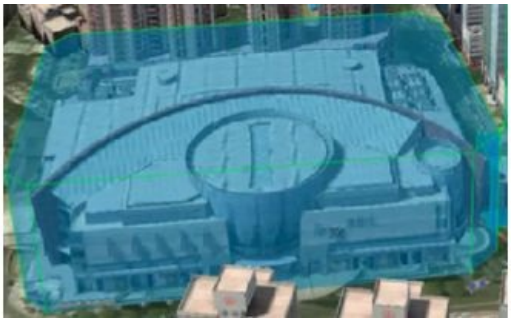
Surveyor 2.0, Land Administration and More



Richard Groom provides pointers to articles from the FIG Congress in May. Papers can be downloaded from https://bit.ly/2yz8xlB.

Changing Survey

Muller and Klein (TS06C) look at moves to update the role of the surveyor – known as 'Surveyor 2.0'. Surveyor 2.0 measures, models and manages geospatial data. Although many of us already manage data, the paper formalises this and therefore helps clarify what is probably a grey area for many. The paper covers methodological and social skills as well as the nuts and bolts and is well worth reading.

Buxton and Harrington (TS08G) asked "Will technology ever replace the human touch?" The authors are 'millennials' and the focus of their thoughts was land rights. The paper is thought-provoking. They discuss the digital divide, 'free prior and informed consent' and other factors and invite readers to consider the technological response. They then run through what is effectively a useful glossary of the terms and acronyms used in land administration.

Wasstrom (TS05B) describes an initiative from the Nordic countries to provide an international mentoring / training programme for developing countries. Lantmateriet of Sweden started the programme in five African countries. Themes include surveying, land registration, planning, valuation and land information systems.

Lundsten and Paasch (ISS03J) have studied the issues involved in trying to get a team to work together on writing standards. Whilst participants recognise the need for their work on standards they find conflicts with their 'day job'.

Land Administration

Ertunc and Cay (TS01G) consider land consolidation and note that the reallocation of parcels is the most difficult and time-consuming part of the process with many factors to be considered. They describe a computer-based reallocation model which eases the difficulties and have tested it. It is a hybrid of interview-based reallocation which requires farmers to make three preferences and a 'block priority-based' reallocation method which is based upon the largest block owned by each landowner. The result is a higher consolidation rate along with time and cost savings.

In TS01I, Velpuri et al ask the question "Does Fin Tech lead to sustainable real estate management?" The answer is, of course, 'yes'. They see 'smart contracts' and blockchain (distributed ledger technology) as central to streamlining property transactions and recording, and work is proceeding via ISO technical committees. Fin Tech is already being used in some countries. These technologies, because they are public and not under the control of individuals would, the authors say, be suitable for quantifying progress towards the Sustainable Development Goals. This article is a glimpse into the not so distant future and well worth an hour or two of CPD.

Cemellini et al (TS05C) discuss visualisation of 3D cadastre data by comparing the features of six web viewers in a useful table. This image illustrates the use of transparency to enhance the difference between physical and legal objects (Pouliot, et al., 2017).

Seiffert (TS05G) describes a process for automatic validation of cadastral data in Germany. It addresses an area which is important if data is to be interoperable and so it is topical. This area has been neglected and the article gives some pointers to the difficulties ahead.

Newsome and Griffith-Charles (TS10G) have devised a combination of the Land Administration Domain Model (LADM) and the Social Tenure Domain Model (STDM) to create a hybrid integrated Legal and Social Tenure Domain Model (LSTDM). In Jamaica, LADM is the foundation, but it has been adapted to represent the social relationship between people and land. The change is affected using lookup tables to accommodate informal rights which may be documented or undocumented. The system takes full advantage of Free Libre Open Source Software (FLOSS).

Torun (TS10G) describes a means of using blockchain to record boundary adjustments arising from trying to reconcile historical cadastral plans. There are three components – a blockchain database to handle communication and trace transactions, GIS/CAD to handle the geometric part of the survey, and 'middleware' to synchronise the database and the GIS/CAD. The article includes a case study. It is quite tough reading but should help those of us who struggle to understand this technology.

Geodesy

In TS02D, Abdul Hamid et al discuss the variability of sea level rise across the Malaysian seas over the last 23 years by using satellite altimetry. Sea level has been rising by 3.3mm per year in the Malacca Straits, increasing to 4.9mm per year at the Celebes Sea to the east of Borneo. The authors therefore argue that regional variations are significant. They also compare the results with tide gauge data.

Lyszkowwicz and Bernatowicz (TS05D) have used GNSS data co-located at a Polish tide gauge to decouple sea level rise recorded at the tide gauge from ground movement recorded by the GNSS receiver. They conclude that sea level rise is 2.99mm per year +/- 0.4mm.

Handouts from two presentations in TS05E on positioning are worth skimming through. Kealy and Retscher cover indoor positioning whilst Lidberg presented on reference frames in a dynamic world.

In TS06E, there were a couple of papers about reduction of gravity observations but of more general interest is Ahlgren et al (TS06E), which describes progress towards GEOID2022 in north America, involving the collaboration of geodesists in Canada, the US, and Mexico. Engfeldt et al (TS06E) describes the RG2000 gravity reference frame in Sweden. The most significant development is the use of modern precise absolute gravimetric observations. They have co-located new with previous observations where possible.

In (TS07E) Roman focuses on the establishment of Foundation Continuously Operating Reference Stations (FCORS) across US territories. The FCORS will be used to determine the Euler pole parameters for the reference frames for each territory. This means the latitude and longitude of each Euler pole and its rotation. It is critical to choose the right locations for the FCORS and this involves international collaboration.

Pearson et al (TS10E) presented a paper on developing a regional deformation model for the South Pacific. This is a combination of normal continental drift movements (plate rotation) with sudden deformations caused by earthquakes. They make the point that the latter depends on the availability of dense GNSS data and that for some earthquakes, such as the one which hit Vanuatu, there is little data available. Wan Aris et al (TS10E) tackle the same problem for the Malay peninsula treating the plate rotation trends together with the non-linear effects during and after earthquakes and compares two models for several earthquakes.

Capua (TS08C) sets out the pros and cons of using precise point positioning over conventional network RTK for cadastral surveys. PPP requires only a sparse network of continuously operating GNSS receivers. He provides a cost-benefit analysis to demonstrate that PPP is more efficient.

Engineering

Li and Shiengxiang (TS02F) had unusual tunnels as their subject. Tunnel elements (38m x 11m x 180m) are prefabricated, floated to the tunnel site, placed in a trench and sealed with neighbouring elements using watertight gaskets. The elements must line up ‘exactly’, to +/-35mm between adjacent elements and +/-50mm for absolute position. To achieve this, you need a precise control survey which is described in the paper.

Schmid et al (TS02F) gave a presentation on the transfer of azimuth from the surface to tunnels using an IMU-based system and simulation software to compute the accuracy of transfer.

Zahari et al (TS02F) describe a system for detecting shallow underground objects using seismic reflection techniques. Their results are encouraging with an 88% successful detection rate, comparing favourably with GPR. Research is continuing into detection of other objects, such as fibre optic and power cables.

Ochieng et al (TS04F) present a method for monitoring deflection and vibration of wind turbine blades and towers using ground-based radar.

BIM and Smart Cities

Abdul Rahman et al (TS03C) consider the level of detail (LoD) as specified in the context of city models as multiple representations of features in a model for different applications. Their paper is fairly heavy going for non-specialists but worth some effort. Rajabifard el al (TS10C) compare LADM, CityGML and IFC for representing boundaries in vertically stratified properties.

Mobile Mapping

Chen et al (TS02F) built a trolley-based mobile mapping system with the intention of observing scans during construction and documenting the difference between as-built and BIM design models. Although the technology is quite familiar the results are interesting, and research is continuing, particularly focusing on supporting technology to improve the trolley’s trajectory.

Frangez el al (TS05C) compare static scanning and mobile mapping using GeoSLAM ZEB-REVO and Leica Pegasus:Backpack for surveying a 350m gold mine gallery. The authors use a number of criteria for their comparison and conclude, unsurprisingly, that best tool depends upon the purpose of the survey. The pros and cons of each technique are listed in the conclusions section. This is well worth reading.

Point Cloud Processing

Becker et al (TS05F) tackle classification of aerial photogrammetric point clouds using machine learning with geometric and colour information to classify each 3D point. To classify geometry, they successively down-sample the point clouds to produce eight point clouds between the original GSD of 5.1cm and largest derived GSD of 20.4cm. They compute colour using HSV (Hue, saturation, value) as opposed to RGB – using the colour of the point itself and the average colour of nearby points from the original point cloud. The authors explain the classification process and present some impressive results.

Hassan et al (TS05F) combine ground-based synthetic aperture radar (GB-SAR) with GNSS to detect movement of unstable slopes near the Three-Gorges Dam in China. GB SAR detects movement along the line of sight frequently and throughout the SAR image whilst GNSS can be used to detect 3D displacements precisely for a low density of points. The authors explain the observation technique and processing – pointing out that the SAR measurements are sensitive to atmospheric effects.

Maltezos et al (TS11C) consider change detection for buildings using aerial imagery taken at two epochs over two areas. The authors use 'convoluted neural networks' to aid classification. The results are impressive, but the authors suggest that it is a tool for reconnaissance to find changes for further investigation.

Kaiser et al (TS09F) compare the structure from motion software packages as applied to 3D recordings of traffic accidents. Much of this is more generally applicable and this paper is useful for anyone involved in digital photogrammetry. Critical to determining camera positions is the effectiveness with which the software identifies key points, with even distribution across the models.

Li et al (TS08E) in a paper, which was not presented at the conference, have studied the methodology for the semi-automated generation of horizontally curved driving lanes from point cloud data to aid autonomous driving. The paper presents machine learning based approaches to extract road edges and lane markings from 3D point clouds. Horizontal curves are a particular hazard and the authors concentrate on detection of edges and markings on curves.

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