

# FIG Commission 3 – Spatial Information Management

## Work Plan 2019–2022

### 1. Title

Spatial Information Management

### 2. Terms of Reference

- The use of Spatial Information Management SIM (geospatial data, tools, procedures, regulations, standards);
- The support of good governance (sustainable development, poverty reduction, social and economic growth, social security);
- Spatial data infrastructure SDI;
- The use of crowdsourced Volunteered Geographic Information VGI to geoscientific disciplines that make use of mapping, GIS, and SDI systems and procedures;
- The research of the methods for the sustainable development especially of urban areas and emerging countries with high index of development;
- The study and monitoring of spaces, as control of the fragility and vulnerability of the territory.

### 3. Mission Statement

The mission of Commission 3 is to:

- Increase awareness about successful SIM approaches and achievements by showing good practice like availability, reliability, efficiency and accessibility of spatial information for better decision making and processes;
- Support the use of spatial information and SIM-tools by surveyors and by all participants in decision-making to serve the goals of good governance;
- Share good practice on managerial processes and infrastructure required for geospatial data handling, using information and distributing knowledge;
- Share good practice and develop high-level methods and techniques for merging and managing updated spatial information at various levels according to market requirements;
- Establish and maintain geospatial data - and data-quality-standards relevant to SIM, while cooperating with international spatial data standard committees;
- Encourage the use of spatial information within e-government and e-commerce;
- Support the knowledge exchange among inter-generations in spatial sciences;
- Cooperate and coordinate with the related United Nations Committees and other geospatial information societies and organizations active in the field based on request from the Council.

#### 4. General

Objectives, topics and scope of the previous term will be maintained and updated as appropriate. Commission delegates have expressed their interest in continuing organizing Commission annual meetings and workshops focused on the specific and identified current topics.

Specifically, Commission 3 will:

- Focus on Geospatial Information Infrastructures by contributing to improved decision making and outcomes in society through sharing knowledge and advances in geospatial information infrastructure and technology and their integration and enablement for smart cities at the local, regional and global levels,
- Investigate the opportunities and challenges and propose a framework for understanding the ways that Geospatial Big Data may be obtained, processed, presented, shared and best used together with data derived from traditional surveying methods to provide richer datasets, and to be used in ways that are complementary,
- Investigate and identify initiatives and projects that make use of user-generated spatial content. Focus will be given to collection, processing, mining, interpretation, administrative, and analysis levels. New means and technologies on how to exploit and make use of user-generated spatial content and derived information to geoscientific disciplines, such as mapping, land surveying, GIS, land administration and cadastre, navigation, etc. will be searched. User-generated spatial content enables citizens and communities to take part in processes having geospatial aspects, and having a direct contribution on their life, empowering and mandating them as pertinent stakeholders,
- Contribute to the upcoming revision of ISO19152:2022 (LADM) by further developing the 3D aspects in this international standard, relate to marine cadastre and 3D cadastre in mega cities, collect and exchange experiences of operational 3D cadastral systems, Voluntary Geographic Information (VGI) based 3D data collection, integration of 3D space and time (4D Cadastre), 3D Cadastre as input for valuation, BIM/IFC,
- Gain a better understanding of developing useful GIS tools for spatial planning, based on the different phases in the spatial planning cycle. Having appropriate and user friendly GIS tools available will create a positive spin-off in terms of enhancing information transparency and increase inclusiveness among participating stakeholders,
- Contribute significantly in meeting the UN Sustainable Development Agenda 2030 Goals, such as ‘Sustainable Cities and Communities’, ‘No Poverty’, ‘Zero Hunger’, ‘Climate Action’, by raising awareness on how society -professionals/business, governments and people- can benefit from enhancing the usability of user generated content, Volunteered Geographic Information VGI and Geospatial Big Data GBD,
- Building a close partnership with FIG Young Surveyors Network within Commission’s scope by addressing the link between the changing role of surveyors in the society based on the near future geospatial technologies and next generations. Young Surveyors in transition have expressed their interest to bring along a synergy of young professionals into Commission activities, an awareness of the new professional perspectives with good applications in industry, with along Commission events and stand-alone activities. Commission 3 will provide a platform for the continuum of the members of the new generation geospatial professionals who are aware of the society through various ways and FIG Young Surveyors Network and who are willing to take next level of experiences by contributing to FIG under Commission 3 topics.

## 5. Working Groups

### Working Group 3.1 – Geospatial Information Infrastructure for Smart Cities

#### Policy Issues

Geospatial Information Infrastructure is an enabling infrastructure that can support and integrate the increasing number of geospatial related sensors in cities and communities. Geospatial information infrastructure facilitates timely information services for citizens, governments and business across cities, regions and countries. It contributes to the delivery of improved outcomes in key areas such as urban planning, transportation, health, education, environmental management and supports economic development. The key aim of the working group is to contribute to improved decision making and outcomes in society through sharing knowledge and advances in geospatial information infrastructure and technology and their integration and enablement for smart cities at the local, regional and global levels.

#### Chair

Prof Kevin McDougall (Australia), email: [kevin.mcdougall\[at\]usq.edu.au](mailto:kevin.mcdougall[at]usq.edu.au)

#### Specific topic(s)

- Geospatial information infrastructure challenges
- Integrating authoritative and crowdsourced data
- Data sharing and data openness: open source, open standards, open data.
- Managing geospatial information for smart cities and sensor integration
- Applications for geospatial information infrastructure in smart cities
- Semantic technologies, geospatial ontologies, geospatial data analytics
- Crowdsourced geospatial data, citizen geo-participation, empowerment and decision making for smart cities.
- Future ICT and geospatial technologies to support geospatial information infrastructure and smart cities

#### Workshop(s)

Participations in FIG Working Weeks and other major Commission events with dedicated technical sessions and/or workshops as appropriate.

#### Beneficiaries

Surveyors, geospatial professionals and allied professions, associations engaged with spatial data, local and regional municipalities and users of geospatial data and spatial information.

#### Publication(s)

- Produce a special issue on Geospatial Information Infrastructure for Smart Cities in the scientific journal ISPRS IJGI (2020/2021),
- FIG publication on Smart Cities (2022)

### Working Group 3.2 – Geospatial Big Data: collection, processing, and presentation

#### Policy Issues

The definition of “Big Data” is complex and constantly changing, mainly based on the three Vs definition of their characteristics, such as “Big data represents the information assets

characterized by such a high **Volume, Variety and Velocity** to require specific technology and analytical methods for its transformation into value”, or “data sets characterized by huge amounts (Volume) of frequently updated data (Velocity) in various formats, such as numeric, textual, or images/videos (Variety)”.

A significant portion of big data is actually *geospatial* data, and the size of such data is growing rapidly at least by 20% every year due to the rapid technological development. Geospatial big data (GBD) collection methods include surveying, photogrammetry, remote sensing, LIDAR/Laser scanning, VGI, Mobile mapping systems, GNSS tracking, real time sensor observations, geo-sensor networks, IoTs, etc. The various types of GBD include raster data (e.g., geoimages-aerial, satellite, etc-, 3D objects), vector data (e.g., points, lines, polygons), and graph data (e.g., road networks, topological coverage, grid data).

The “Volume” characteristic of the GBD deals with issues related to data storage and massive analysis; the “Variety” deals with issues related to data management models and structures as well as indexes; while “Velocity” refers to issues such as matching the speed of data generation and processing. However, the three Vs definition is further expanded with more characteristics, such as the one called “Veracity” which refers to quality assessment of source data, data improvement, etc.

The increasing volume and varying format of collected GBD presents challenges in storing, managing, processing, analyzing, visualizing and verifying the quality of data.

The target of Working Group 3.2 will be to investigate the opportunities and challenges and to propose a framework for understanding the ways that GBD may be obtained, processed, presented, shared and best used together with data derived from traditional surveying methods to provide richer datasets, and to be used in ways that are complementary.

WG 3.2 will contribute to UN SDG 11 (Sustainable Cities) but also to SDG 1 (No Poverty) and SDG 2 and 3 (Zero Hunger) and 13 (Climate Action).

WG 3.2 will focus to motivate researchers in academia and industry, students, as well as delegates from the state sector to partner and join efforts to *improve the value of GBD for the society as well as to take advantage of this value for improving the surveying profession*. Inter-commission activity as well as collaboration with other FIG Com3 WGs in this field will be encouraged.

#### Chair

Prof Charalabos Ioannidis (Greece), email: cioannid@survey.ntua.gr

#### Specific topic(s)

Topics of interest of WG 3.2 include the following:

Topics of general interest/raising awareness

- Good practice applications of GBD in land administration, economy, health, planning, 3d modelling, climate change, disaster response, monitoring infrastructure, transportation, agriculture for the Sustainable Development Agenda 2030
- GBD in GIS (import, analysis, processing tools, presentation)
- Case studies using GBD

- Platforms for sharing GBD
- Policies/legislation

#### Technical topics

- Hardware and Software for GBD collection and processing
- IoT and surveying activity
- Spatial computing techniques/methodologies
- Algorithms of GBD processing
- Visualization of GBD
- GBD and mobile devices
- GBD handling methods in storing, managing, processing, analyzing, visualizing, verifying the quality of data, data security
- Cloud computing and cloud storage for efficient access and process of GBD
- Methodological/Theoretical/Technical developments in modelling, processing, analyzing, visualizing GBD
- Data mining for decision support
- Knowledge discovery from GBD
- Cluster-based systems for processing GBD

#### Workshop(s)

- Participation in the FIG WWs and FIG Commission 3 Annual Meetings and Workshops
- Organization of focused sessions/seminars on relevant topics
- Organization of inter-commission activity/publications during joint workshops.

#### Beneficiaries

Surveyors of the public and private sectors and academia, scholars, governments, business and people (society/economy/environment).

#### Publication(s)

- contribute to joint publications with WG 3.1

### **Working Group 3.3 – User-Generated Spatial Content Empowering Communities**

#### Policy Issues

The neogeography revolution of Volunteered Geographic Information (VGI) and Participatory Mapping encapsulates the idea of communities that create, share, visualize, and analyze geographic and geospatial information and knowledge. Spatial Data Infrastructure (SDI), as well as Spatial Information Management (SIM), can benefit greatly from the use and integration of this paradigm. User-generated spatial content is becoming a legitimate and reliable spatial, environmental and sustainable infrastructure on local and global scales. It enables citizens and communities to take part in processes having geospatial aspects, having a direct contribution on their life, empowering and mandating them as pertinent stakeholders.

The emphasis of Working Group 3.3 will be on the investigation and identification of initiatives and projects that make use of user-generated spatial content as an enabler to processes,

infrastructures and services to communities. Focus will be given to collection, processing, mining, interpretation, administrative, and analysis levels. Working Group 3.3 will search and learn new means and technologies on how to exploit and make use of user-generated spatial content and derived information to geoscientific disciplines, such as mapping, land surveying, GIS, land administration and cadaster, navigation – and more.

Working Group 3.3 will aspire to motivate and work with scholars, professionals and communities, with the focus on developing countries, where this has the potential to contribute and strengthen utmost. Working Group 3.3 will aim to have joined and mutual interests and sharing of ideas and knowledge with other FIG Commissions, specifically Commission 2 (on Professional Education), Commission 7 (on Cadastre and Land Management) and Commission 8 (on Spatial Planning and Development).

#### Chair

Prof Sagi Dalyot (Israel), email: [dalyot@technion.ac.il](mailto:dalyot@technion.ac.il)

#### Specific topic(s)

- Utilization of crowdsourced user-generated spatial content in SDI, SIM and environmental knowledge
- Working methodologies of user-generated spatial content in developing countries
- User-generated spatial content collection, analysis, and visualization
- Crowdsourced land administration management tools
- Initiatives of spatial information solutions addressing global and national challenges
- User-generated spatial content standards, uncertainty, ethics, authenticity, validity
- Applications making use of user-generated spatial content in managing the built environment
- Case studies and processes

#### Workshop(s)

Participations in the FIG Working Weeks and the Commission Workshops and Annual Meetings. The initiation of joint meetings and workshops with other FIG commissions and relevant international working-groups.

#### Beneficiaries

Citizens, communities, land surveyors, scholars, local and regional organizations.

#### Publication(s)

- contribute to joint publications with WG 3.1

### **Working Group 3.4 – 3D Cadastres (Joint Working Group with Commission 7)**

#### Policy Issues

During the recent years 3D Cadastre has matured. The increasing complexity of infrastructures and densely built-up areas require a proper registration of the legal status (private and public), which can be provided only to a limited extent by the existing 2D cadastral registrations. Addressing this challenge has been the main goal of the International Federation of Surveyors (FIG) joint commission 3 ‘Spatial Information Management’ and commission 7 ‘Cadastre 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, both above and below surface. The level of sophistication of a 3D Cadastre in a specific country will in the end be based on the user needs, land market requirements, legal framework, and technical possibilities.

In the foreword of the FIG Publication 'Best Practices 3D Cadastres', FIG Past President Chryssy Potsiou comments that "we, as geo-information professionals, vendors, providers, managers, professionals as well as academics and researchers, are expected to develop services and tools to deliver administrative, economic and social benefits. Our colleagues, representatives of business, academia and public administration; managers of geodata from all over the world; young entrepreneurs and creative minds; all are working toward the same goal, trying to increase the "value" of geodata for the people. They do so in order to get more benefit, more transparency, more safety, more environmental quality, more growth, more fairness, more efficiency in governance of urban areas, more smart cities. No reality has a more direct bearing on the subject of 3 dimensional geo-information and cadaster than the growth of large cities, especially in the developing countries of the world, and especially in the phenomenon of the mega cities."

As cities grow they 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 cadastre concept, by adding the time dimension to the equation. In a discussion of "cost effectiveness" one must consider time, that 4<sup>th</sup> 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 on-going 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.

Reference: Best Practices 3D Cadastres - Extended version, Editor: Peter van Oosterom, International Federation of Surveyors, Copenhagen, Denmark, March 2018 (ISBN 978-87-92853-64-6, ISSN: 2311-8423), [http://www.fig.net/resources/publications/figpub/FIG\\_3DCad/~FIG\\_3DCad-final.pdf](http://www.fig.net/resources/publications/figpub/FIG_3DCad/~FIG_3DCad-final.pdf)

#### Chair

Prof Peter van Oosterom (The Netherlands) [P.J.M.vanOosterom@tudelft.nl](mailto:P.J.M.vanOosterom@tudelft.nl) and Prof Alias Abdul Rahman (Malaysia) [alias@utm.my](mailto:alias@utm.my)

#### Specific topic(s)

- Contribute to the upcoming revision of ISO19152:2022 (LADM) by further developing the 3D aspects in this international standard; e.g. provide a more formal taxonomy of different types of 3D parcels (spatial units), define 3D spatial profiles,
- Relate to Marine Cadastre with 3D volumetric parcels and their (international) boundary descriptions,

- Collect and exchange experiences of operational 3D cadastral systems (law, organization, technology),
- 3D Cadastre in megacities, often in Latin America (Brazil, Mexico), Asia (China, Malaysia, Korea, Singapore) and Africa (Nigeria),
- 3D Cadastre usability studies, web dissemination and 3D cartography (including VR and AR techniques),
- Deep integration of 3D space and time (4D Cadastre) for more robust foundation,
- New data acquisition techniques, including Voluntary Geographic Information (VGI) based 3D data collection,
- 3D Cadastre (and 3D Topography) as input for more fair valuation as basis for taxation, and
- 3D Cadastre as part of the full life cycle in 3D (spatial planning and development), linking BIM/IFC and 3D Cadastres.

#### Workshop(s)

- Collaborate with ISO TC221 (2 times per year meetings) and OGC (the DWG Land admin, 5 times per year potential sessions at OGC TC meetings) on the revision of LADM,
- Organize future 3D Cadastres workshops (planning: 2020 and 2022, at least once in South/Middle/North America),
- Participate and organize 3D Cadastres sessions at FIG working weeks (especially 2020, Amsterdam) and FIG Congress,

#### Publication(s)

- Conduct and analyze the new term 3D Cadastres questionnaire 2018-2022 (after 2010-2014, and 2014-2018 questionnaires),
- Produce a special issue on 3D Cadastres in the scientific journal ISPRS IJGI (2019/2020),
- Maintaining FIG 3D Cadastres website <http://www.gdmc.nl/3DCadastres/> (a.o. with relevant publications),
- Send four times per year an email newsletter to update members of working group, and
- Possibly an update of FIG publication Best Practices 3D Cadastres (2022),...

#### Beneficiaries

Legal experts, Surveyors of the public and private sectors and academia, scholars, governments, business (including financial sector) and general public (society/economy/environment).

### **Working Group 3.5 – GIS Tools for Spatial Planning (Joint Working Group with Commission 8)**

#### Policy Issues

GIS tools hold great potential to support spatial planning practice. Ongoing developments in digitalization of data sets and communities further open up possibilities to apply GIS tools in spatial planning processes. The latter typically follow a cyclic pattern: (1) development of spatial policies, (2) policy implementation, and (3) monitoring and evaluation. Spatial policies



range from strategic visions to land use plans that at operational level determine and distribute land use types. Together with legislation and rules, these spatial policies constitute the framework for implementation of spatial policies. Programmes, projects, enforcement mechanisms and the like can be used to implement spatial policies, depending on the situational context. Finally, monitoring and evaluation is necessary to measure whether policy aims are met or need to be adapted, which may lead to the development of new spatial policies.

Due to the different nature of each phase in the cycle, GIS tools to support spatial planning practice will require different data specifications, functionality and usability features. This working group aims to gain a better understanding of developing useful GIS tools given a particular planning exercise, based on the different phases in the spatial planning cycle. Having appropriate and user friendly GIS tools available will create a positive spin-off in terms of enhancing information transparency and increase inclusiveness among participating stakeholders.

#### Chair

to be nominated

#### Specific topic(s)

- Examine current GIS tools used in spatial planning practice and consider the potential role for future applications.
- Develop guidelines based on best practices regarding data standards, functionality and usability of GIS tools.
- Encourage the use of spatial information and public participation in spatial planning by using e-government.
- Foster transparency, inclusiveness and legal certainty in decision-making by providing tools for stakeholders to access information and participate in spatial planning processes.

#### Workshop(s)

Participations in the FIG Working Weeks and the Commission Workshops and Annual Meetings. The initiation of joint meetings and workshops with other FIG commissions and relevant international working-groups.

#### Publication(s)

Website or other interactive digital platform to provide the results of the GIS tools analysis. FIG publication: GIS tools for spatial planning – Best practices and guidelines.

#### Beneficiaries

FIG Member associations, Governments, Citizens, Business (GIS solutions).

### **Working Group 3.6 – Geospatial Next (Joint Working Group with Young Surveyors Network)**

#### Policy Issues

The Industrial Revolution 4.0 and the technologies emerging in daily life such as machine learning, AI and robotics; new challenges are at the doorstep for the societies. For millennia surveyors managed to benefit the technological advancements to answer the changing needs in

respect of geospatial data/information for the societies. Yet, output of the ongoing revolutions are expected to change professions and working cultures deeply, perish some occupations and bring new ones into daylight.

International Federation of Surveyors is a well-established society, which is aware of this wave of change approaching for a long period. This issue has been addressed in many events of the FIG, Commissions and Young Surveyors Network. To contribute these efforts, the new working group will maintain the link with the changing role of surveyor in the society based on the near future geospatial technologies and next generations within the scope of the Commission 3 Spatial Information Management.

The working group should be considered as a respond to contribute to the technological and organizational skills for the changing needs of the surveyors to exist in the dawn of the new industrial era and produce together with inter generations of geospatial professionals in Commission 3. Therefore, this working group will be able to work with various professional level groups together with the other Com. 3 Working Groups where it is possible.

#### Chair

Cemal Özgür Kivilcim (Turkey) [kcemalozgur@hotmail.com](mailto:kcemalozgur@hotmail.com)

#### Specific topic(s)

The proposed working group will work to bring along a synergy of young professionals into Com. 3 activities, an awareness of the new professional perspectives with good applications in industry, with along Commission events and stand-alone activities. It should be also seen as a platform for the continuum of the members of the new generation geospatial professionals who are aware of the society through various ways and FIG Young Surveyors Network and who are willing to take next level of experiences by contributing to FIG under Commission 3 topics.

The events should be considered in digital and in physical forms. The working group could propose and organize events such as online/in demand podcasts and trainings as well as workshops/trainings. Further to this, competitions related to innovative geospatial solutions and ideas/applications may be organized through online or during events. Additional standalone events may be proposed through the term. The events should be specific to Commission 3 topics and they should be considered not to conflict with the existing ones such as organized by FIG Young Surveyors Network.

The working group require to use the social media efficiently to make sure itself and Commission 3 activities are circulated and as well as trustworthy geospatial developments may be circulated (such as from sister and regional organizations or industry specific applications) through group channels.

The working group members should seek possible support from geospatial industry and academia, as well as their affiliated organizations and national FIG members. However, support from working groups and commission 3 as well as FIG Foundation might be considered to support possible needs if needed such as participation to events of WG members with the approval of Com.3 and related authority (FIG Council and FIG Foundation).

### Workshop(s)

Participation in the FIG Working Weeks and the Commission Workshops and Annual Meetings. The working group will propose and organize events such as online/in demand podcasts and trainings as well as workshops/trainings. A special session may be organized in the annual meetings of the Commission 3. Further to this, competitions related to innovative geospatial solutions and ideas/applications may be organized through online or during events. Additional standalone events may be proposed through the term. The events will be specific to Commission 3 topics and they will be considered not to conflict with the existing ones such as organized by FIG Young Surveyors Network.

### Publication(s)

The working group require to use the social media efficiently to make sure itself and Commission 3 activities are circulated and as well as trustworthy geospatial developments may be circulated (such as from sister and regional organizations or industry specific applications) through group channels.

### Beneficiaries

Geospatial industry, academia, FIG member associations, Young Surveyors in transition.

## **6. Co-operation with other Commissions and Organizations**

Commission 2;

Commission 7; joint Working Group 3.4 3D Cadastres

Commission 8; joint Working Group 3.5 GIS Tool for Spatial Planning

Young Surveyors Network; joint Working Group 3.6 Geospatial Next.

## **7. Co-operation with United Nation Organisations, Sister Associations and other Partners**

UN-GGIM - UN Committee of Experts on Global Geospatial Information Management;  
World Bank;

ISPRS – International Society for Photogrammetry and Remote Sensing, Commission IV on Spatial Information Science;

ICA – International Cartographical Association;

IGU – International Geographical Union, Commission on Geographical Information Science;

## **8. Calendar of Events**

April 2019 – Hanoi, Vietnam (in conjunction with FIG WW 2019);

September 2019 – Cluj-Naboca, Romania (Annual Workshop in conjunction with Surveyor's Week, Romania);

May 2020 – Amsterdam, The Netherlands (in conjunction with FIG WW 2020);

October 2020 – Berlin, Germany (Annual Workshop in conjunction with Intergeo 2020, Berlin);

May 2021 – Accra, Ghana (in conjunction with FIG WW 2021);

Fall 2021 – location TBD (Annual Workshop);

May 2022 – Cape Town, South Africa (in conjunction with FIG Congress 2022);

Fall 2022 – location TBD (Annual Workshop).

## 9. Workshops

Commission 3 is planning to organize, in addition to its activity during the annual FIG Working Weeks or Congress, also four Annual Workshops during the 2019-2022 term.

## 10. Commission Officers

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Vice-Chair and Chair of Working Group 3.5  
to be added

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