

Appendix to item 14

Report to the 43rd General Assembly FIG Working Week 2021

FIG Commission 6 - Engineering Surveys

Report of Activities 2019-2020

1. Introduction

2019 was the first year of activity of the new team that will coordinate the activities of Commission Engineering Surveys (better known as C6) between 2019 and 2022. It was, naturally, a year of the start of a new group that wants to continue the work of a commission that has more than 45 years of existence.

2020, as a result of a better knowledge of the internal procedures of FIG, of its communication rules, of the organization of Working Weeks (WW) and the peer review process, would result in a year with a growth and easier activity. Although there is, now, a much better understanding of the FIG “machine”, which has facilitated the integration in its activities, the truth is that the year 2020 had a totally unexpected path. The impossibility of traveling has caused all the activities, planned to happen from March 2020, to have undergone major changes, including the cancellation of some. All members linked to C6 management had to adapt to new ways of working, of dialoguing. Many experienced remote work; teams had to disperse. But is necessary also to recognized that other activities were carried out, as a result of familiarization with web tools, used either in meetings, symposiums or conferences.

The focus of C6 activity has been innovated and renewed as a result of the changes of the concerns, interests and challenges of the surveyors. Not long ago large structures like dams, bridges, buildings with normal dimensions, tunnels, along with techniques like total stations, levels and GNSS receivers, dominated the events and technical sessions of this commission. In the last few years the awareness of our planet’s fragility, the impacts of severe weather conditions together with inadequate human interventions, as well as the construction of defiant structures due to their size or location, are leading to new challenges. Those challenges demand for professionals with top qualification, that are used to push the techniques to their highest levels of accuracy: the engineering surveyors. New techniques and methodologies - like UAV, Laser Scanners, Radar and digital image processing - along with real (or quasi real) time solutions are assets for these professionals. Events organized by FIG (the Congresses or Working Weeks) or by C6 reflect this evolution.

Naturally, new techniques are tested at universities and other research centers. And it is in FIG events, that bring researcher and professionals from enterprises together, is enable the exchange of the newest techniques and methods as well as inspiring applications.

C6 activity is coordinated by Maria Henriques, Portugal (chair) and Corinna Harmening, Austria (vice-chair). It was created three working groups (WG):

6.1 – Deformation Monitoring and Analysis: Wolfgang Niemeier, Germany (chair) and Vassilis Gikas, Greece (vice-chair);

6.2 – Landslides monitoring: Gilbert Ferhat, France (chair);

6.3 – UAV in surveying: Hans Ni, China (chair).

A photo of this group is presented in Figure 1 (unfortunately, Hans Ni was not present).

This report is divided in five sections. After this introduction, the second and the third sections describe the activity of C6 in 2019 and 2020, respectively. In the fourth section the activity developed by the working groups is described. This report ends with the sections dedicated to the Article of the Month and the cooperation with other entities.

2. The activity of C6 in 2019

2.1 Unlike the previous “four year” terms, the chairs of FIG 2019-2022 commissions were elected in May of 2018, during the FIG Congress, a few months before the start of their activity. They didn’t get through the important period of 1.5 years of participation in FIG activity that usually happens between their election and the beginning of their term. This activity includes the participation in ACCO meetings and involvement in the activity of their future commission. For this reason, FIG Council and Office organized a two days meeting in FIG Office, in Copenhagen, in January 2019.

The majority of the commissions chairs (including the chair of the Young Surveyors Network) could participate in this important startup meeting. Mikael Lilje, the vice-president responsible for commissions, coordinated the meeting. On the second day, Rudolf Staiger was also present. He shared his vision of FIG challenges for the next years. During the two days, FIG Office collaborators were present and gave the maximum help, in special Louise Friis-Hansen and Claudia Pedersen.

The two days were important to start the preparation of the Working Week 2019 (with regard to technical sessions) and to become aware of the activity of the other commissions.

The initiative of FIG Council in organizing this meeting was, to me (chair of C6), excellent. FIG Office provided very good conditions, not possible in the ACCO meetings that occur nearby the busy congresses or working weeks. The possibility of being two days concentrated in the work and getting to know each other was most fruitful. Definitely, an initiative to repeat at the beginning of every new term, with the new chairs.

2.2 The second-high period of activity was the Working Week (WW), in Hanoi (April, 22th to 26th), which was preceded by ACCO meeting on the 21th of April.

C6 was responsible for coordinating three technical sessions (Figure 2) and joined C10 “Construction Economics and Management” in one session:

Title	Comm.	Chair	Rapporteur	N.pap.
TS01F: UAV - from Sensors to Applications	6	Joel Van Cranenbroeck	Mehmed Batilović	5
TS02F: Engineering Surveys – Contribution to Data Collection and Mapping	6	Heinz-Juergen Przybilla	Njike Chigbu	5
TS05F: Engineering Surveys – Developing our Methods	6	Nguyen Ngoc Bang	Corinna Harmening	5
TS03J: Digital Construction	10 & 6	Alan Muse	Mercy Iyortyer	5

At the end of the third day of WW the Commission's Annual Meetings took place, conducted by C6 chair with the help of C6 co-chair. Among several matters discussed, the participants in the annual meeting expressed their concern by the fact that, in some areas, surveyors are considered second order professionals and, also, that engineering survey is exercised by professionals with no skills. They express the wish of having standards related with their activity as well as training courses provided by FIG or with FIG involved in the organization (“FIG stamp”).

This meeting was followed by the Commissions dinners. C6 joined C4 and C5, as usual in the last years.

Besides these activities, C6 chair was present in several sessions. To highlight: the Speed Networking (organized by Young Surveyors Network), the FIG booth (Figure 3), the meeting of the Task Force on Governance, and the Special Session on the Sustainable Development Goals & FIG. The aim of this meeting was to describe the role, responsibilities and opportunities of FIG members and delegates towards the UN Sustainable Development Goals. The participants were divided in groups and the one that worked with the theme “Engineering Surveys Professionals” identified the goals that these professionals can contribute more significantly to. In the case of C6 the following goals were identified: i) Goal 6: ensure access to water and sanitation for all; ii) Goal 7: ensure access to affordable, reliable, sustainable and modern energy; iii) Goal 9: build resilient infrastructure, promote sustainable industrialization and foster innovation; iv) Goal 11: make cities inclusive, safe, resilient and sustainable.

2.3 The third high point of activity was the successful 4th Joint International Symposium on Deformation Monitoring 2019 (Figure 4). Being an organization of the Working Group (WG) 6.1, a complete reference to this meeting will be included in the activity of this WG.

Since the majority of the chairs and co-chairs of the WG participated in this symposium, it was organized a meeting the day before the start of the symposium, in order to prepare the activity of the commission.

2.4 Other activities.

In September, C6 chair was invited to be a keynote speaker in the annual symposium of the Engineering Surveying Branch of Chinese Society of Surveying and Mapping, organized by the School of Geodesy and Geomatics of the Wuhan University. The invitation was made by the president of the organizing committee

Prof. Jingui Zou, vice-dean of the School and member of the Institute of Surveying Engineering. Prof. Zou, his students and colleagues provided excellent conditions during her stay in Wuhan.

C6 supported the participation of its co-chair, Corinna Harmening, in the 6th Young Surveyors European Meeting held in Porto, Portugal, on the 11th and 12th of October. The meeting was held under the theme “Mapping the path to sustainability”. About 40 young surveyors, came together to exchange and to discuss their ideas, both in the context of scientific lectures, ranging from the use of laser scanning for speleology over modern land administration systems to eye tracking applications, as well as during social activities. The meeting ended with a charity walking tour through the city center of Porto.

Besides her activities in FIG as chair of C6, Maria Henriques was the president of the organizing committee of the international meeting “Geodecision 2019: Geodecision for Sustainable Communities”. This meeting, supported by FIG, was held in Porto, Portugal, from 9 to 11 of October. The session held on the 11th morning was a joint session with the 6th Young Surveyors European Meeting (Figure 5).

Another activity of Maria Henriques within FIG is as a member of the Editorial board, representing C6. This group is responsible by the management of the peer-reviewed papers submitted to the FIG WW or congresses, and includes the choice of papers reviewers.

3. The activity of C6 in 2020

3.1 The first activity of 2020 was a presential meeting at the National Institute of Applied Sciences (INSA) at Strasbourg, between the chairs of C6 and WG6.2 (Figure 6). Besides his activities in the Department of Civil Engineering and Surveying, Gilbert Ferhat, chair of WG6.2, is a member of the French National Landslide Observatory where he coordinates the activities related with the monitoring of surface displacements with geodetic (terrestrial, aerial or satellite) techniques. His experience will be most valuable for the project of C6 of publishing a report related to the monitoring of landslides and rock falls.

3.2 The commission's second major activity took place in a very unexpected way. The XLIII General Assembly and the WW2020 were canceled (the reasons are known to all) but the technical part of the WW was maintained, not only with the creation of the technical sessions but also with the contribution of the C6, along with the other commissions and networks, to articles that “highlighted the hot topics, the ground breaking research and the hidden gems in the proceedings”.

C6 was responsible for coordinating three technical sessions, and joined the former IAG working group 4.1.3 “3D point cloud based spatio-temporal monitoring” and FIG C5 “Positioning and Measurement” in a total of three sessions:

Title	Commission	N.º papers
TS01B: UAV & Photogrammetry: Techniques for Smart Surveyors	6	6
TS03B: Deformation Modeling for Smarter Surveying	6 & 5	4
TS04B: Areal Measurement Techniques in Engineering Surveying (Laser Scanner & InSAR)	6	6
TS05B: Point Cloud-based Monitoring in Engineering Surveying	6 & IAG-WG 4.1.3	6
TS06G: Geodesy and Engineering (ISS - Inspirational Short Session)	5 & 6	12
TS08B: Modern Technologies in Structural Monitoring	6	6

3.3 The long cooperation of C6 with the Department of Surveying of the Slovak University of Technology, resulted in the involvement of the commission in the organization of the *8th INGEO International Conference on Engineering Surveying*. The aim of this conference is to bring together professionals in the field of civil engineering and engineering surveying, to discuss the new technologies, their applicability and operability. In 2020 this conference was linked to the 4th SIG Symposium on Engineering Geodesy, organized by the Croatian Geodetic Society.

Scheduled to take place in Dubrovnik, these two events have become virtual, having taken place on the 22th and 23th of October.

Maria Henriques was invited to be a member of the scientific committee of the conference

3.4 C6 supported the 28th *SCEgeo Conference Surveying, Civil Engineering, Geoinformation in Sustainable Development*, organized by the Faculty of Civil and Environmental Engineering and Architecture of the UTP University of Science and Technology (Poland). The Conference subject was on the role of surveying and geoinformation in the economy and engineering activities in the field of design, implementation, management, and monitoring buildings and structures in the aspect of sustainable development.

The Conference took place from the 2nd to the 10th of June.

For this conference it was developed a poster with a description of FIG and FIG C6 activities (poster n.º 77).

Maria Henriques was a member of the scientific committee of the conference. Unfortunately, the website was not updated and her name was not included in the list of the members of this committee.

3.5 C6 was invited by the Association of Students of Surveying of the National University of Córdoba (AEDAC), Argentina, and by the Argentine Federation of Surveyors (FADA) to participate in the meeting "*Surveyors Day*" that took place from the 22th to the 24th of April (in Argentina, the 23th of April is the "National Surveyor Day"). The theme of this event was the "Role of the Surveyor in Engineering" and Maria Henriques made a

presentation on the theme “Monitoring of civil engineering structures. How photogrammetry, drones and digital image processing can contribute” (Figure 7).

3.6 C6 contributed to several documents:

- comments to the first proof of publication of the Royal Institution of Chartered Surveyors (RICS) series *Insights* “Blockchain - an emerging opportunity for surveyors?”.
- the paper “Key Global and Technology Drivers Impacting Surveying” published in GIM International. This is a joint article by the FIG Commission chairs. The initiative and main authorship are of David Mitchell (chair of FIG C2).

4. Working groups

For the term 2019-2022, three working groups were established, as indicated in the introduction, being that only one, the WG6.1 - Deformation Monitoring and Analysis, remained from the previous term. For this reason, there is still no relevant activity of the new groups - WG 6.2 - Landslides Monitoring and WG 6.3 - UAV for Surveying, to include in this report.

4.1 Concerning the WG 6.1, a Group that began its activity in 1975, it organized the 4th Joint International Symposium on Deformation Monitoring (JISDM2019). This was held in Athens, Greece, from the 15th to the 17th of May. With more than 200 participants coming from all continents, this symposium can be considered to be a real success.

The joint symposium was organized by the School of Rural and Surveying Engineering of the National Technical University of Athens and was supported by FIG, IAG and ISPRS. The president of the local organizing committee was Vassilis Gikas, the co-chair of the WG6.1.

The three keynote speakers - Carmelo Gentile, Charalampos (Haris) Kontoes and Dorota A. Grejner-Brzezinska - introduced the latest tendencies in the field of deformation monitoring and shared their vision on the evolution of technologies and methods for monitoring both natural phenomena and man-made structures.

A total of 132 papers (95 oral and 37 poster) covered several topics that included: i) quality control, quality assurance and optimization techniques in deformation analysis; ii) point cloud-based space-temporal deformations; iii) reference frames and geodynamics; iv) cultural heritage/ bridge / dam / geohazards monitoring; v) multi-sensor systems and new concepts for deformation measurements; vi) UAV for change detection and deformation monitoring.

Special issues of the Journal of Applied Geodesy (De Gruyter), of the Journal of Applied Geomatics (Springer) and of the Journal Sensors (MDPI), that will include an extension of selected articles presented at the symposium, are in progress.

In the closing session the chair of the WG6.1, Wolfgang Niemeier, made a short report of the event and announced that the next JISDM, the 5th, will take place in Valencia, Spain, in 2022.

The WG 6.1 started the organization of the 5th JISDM with the help of the Polytechnic University of Valencia, Spain. This symposium will be held in Valencia from the 4th to the 6th of April, 2022. As the previous event, the 5th edition will be endorsed by the three leading scientific and professional organizations in the field: FIG, IAG and ISPRS.

4.2 Hans Ni, chair of the WG 6.1, organized

- the Seminar on Advanced UAV Lidar (Figure 8), held in Deqing, China, on the 4th November 2019
- the Seminar on Geospatial Information, Ecological Environment and Sustainable Development (Figure 9), held in Deqing, China, on the 15th and 16th of December 2019.
- The workshop with FIG C1 on Professional Standards and Practice of Surveying and Mapping in Countries along the Belt and Road Routes (Figure 10), held in Deqing, China, on the 16th -18th September 2020.

5. Article of the month

Some papers of C6, some submitted to WW 2019 and 2020, were selected to be Article of the Month:

- January 2020: "Detection of Service Pipes and the Risk of Collapsing Sinkholes at the Lake of Constance in Switzerland Using Ground Penetrating Radar (GPR)", written by Edi Meier, Inma Gutiérrez, Marco Baumann, Max Bosshard and Rainer Heeb;
- March 2020: "China's Geospatial information industry fights against COVID-19", written by Prosper Washaya & Minyi Li, Deqing iSpatial Co., Ltd, China.
- August 2020: "Unmanned Aerial Vehicle for Topographical Mapping of Inaccessible Land Areas in Ghana: A Cost-Effective Approach" written by Naa Lamkai Quaye-Ballard, Daniel Asenso-Gyambibi and Jonathan Quaye-Ballard;
- March 2021: "Macrotidal Beach Monitoring (Belgium) using Hypertemporal Terrestrial Lidar" written by Greet Deruyter, Lars De Sloover, Jeffrey Verbeurgt, Alain De Wulf, Belgium and Sander Vos.

6. Cooperation

It was established a cooperation with IAG, especially with the WG 4.1.3 "3D Point Cloud based Spatio-temporal Monitoring". The contacts, established during 2019 by the board of this group and C6, attracted some authors to the Working Week 2020, making a technical session with the theme "Point Cloud" possible.

Links were also established with the Joint Technical Committee "Natural Slopes and Landslides" of the International Society for Soil Mechanics and Geotechnical Engineering and with the Scientific Commission "Instruments, Mine Surveying Measurements, Mining Cartography" of the International Society for Mine Surveying.

Figures



Figure 1 - Wolfgang Niemeier, Corinna Harmening, Vassilis Gikas, Maria Henriques, Gilbert Ferhat at the 4th Joint International Symposium on Deformation Monitoring



Figure 2 - Working Week 2019: Presents, chairs and rapporteurs of two C6 technical sessions



Figure 3 - C6 chair at FIG booth during WW2019



Figure 4 - 4th Joint International Symposium on Deformation Monitoring participants



Figure 5 - A group of participants in the first day of the 6th Young Surveyors European Meeting / last day of Geodecision 2019. Corinna Harmening and Maria Henriques can be noticed (left side and middle, respectively)



Figure 6 - Gilbert Ferhat and Maria Henriques at INSA



Figure 7 - Announcement of the presentation of Maria Henriques in the meeting “Surveyors Day” (Argentina)



Figure 8 - Seminar on advanced UAV Lidar

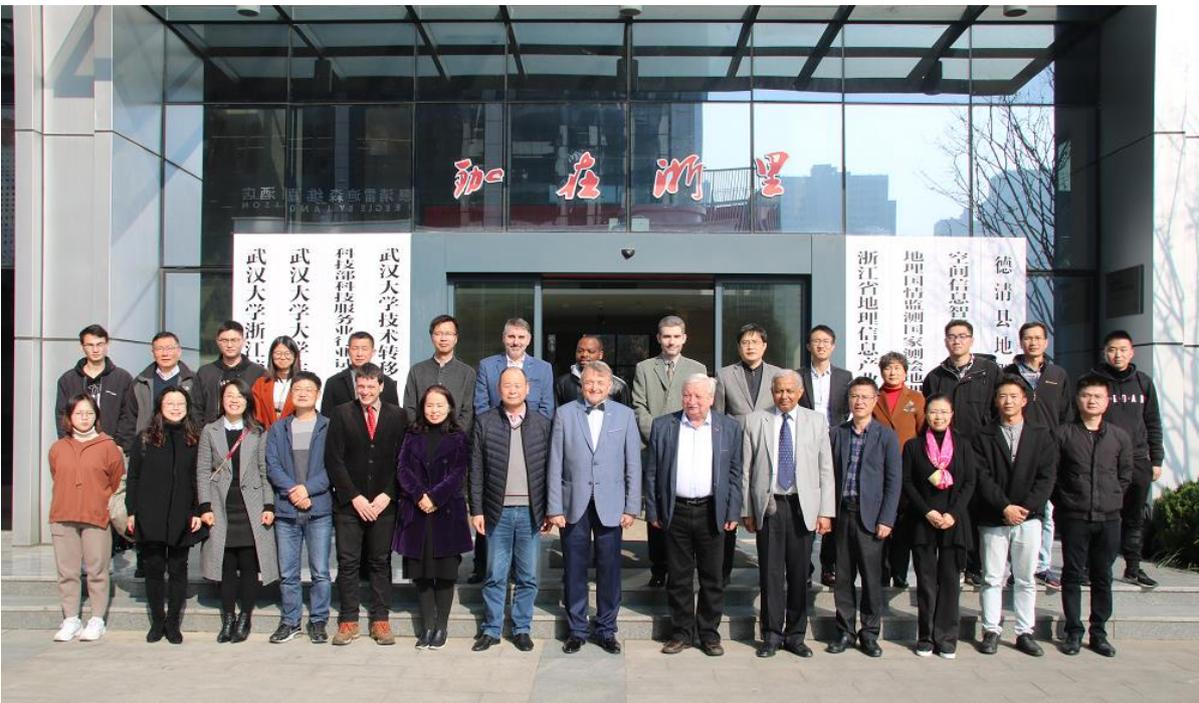


Figure 9 - Seminar on Geospatial Information, Ecological Environment and Sustainable Development



Figure 10 - Opening ceremony of the workshop on Professional Standards and Practice of Surveying and Mapping in Countries along the Belt and Road Routes