

## FIG-Commission 6 - Engineering surveying

The mission of commission 6 is to:

- Support and accompany the development and the implementation of projects in several domains of civil (structural, hydraulic, geotechnical and transportation), mechanical and industrial engineering as well as in highly topical domains like energy production and environmental safety.
- Promote the application of innovative and advanced methodologies and technologies during the design and construction phase as well as throughout the operation phase of the above-mentioned projects.
- Improve the collaboration between engineering surveyors and experts from neighbouring disciplines for a better sharing of knowledge and improvement of results.
- Contribute to the change of professional thinking in order to improve the awareness of our profession.

Work Plan 2019-2022

Commission 6 – Engineering Surveying

### **Terms of Reference**

Design of accurate, robust and reliable surveying systems to be applied to at construction sites or for monitoring proposes.

Validation of surveying equipment

Quality control of measured data

Acquisition of static and/or dynamic data for better understanding the behaviour of structures

Creation and maintenance of integrated geospatial information systems for engineering applications

Improvement of advanced statistical and non-statistical methods to derive reliable information on displacements of structures and natural objects

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Increase the use of aerial and terrestrial photogrammetric techniques in construction sites, visual inspections and displacements monitoring

Integration of multi-sensor systems and data

Implementation of automated surveying systems

Contribution with spatial data for BIM, 3D and 4D visualizations, collaborative virtual environments and augmented reality

## **Mission statement**

The mission of Commission 6 is to:

- Assist the engineering surveyors to have privileged access to the newest knowledge, either in the technology domain or the analysis techniques and methods
- Encourage the development of guidelines and good practices
- Disseminate the benefits arising from the newest engineering surveying techniques among other professionals
- Promote interdisciplinary forums for the exchange of knowledge
- Participate in FIG organizations and cooperate with other FIG Commissions as with FIG Networks
- Cooperate with sister organizations, primarily the IAG and ISPRS, including the organization of joint events

## **General**

Nowadays we are experiencing a period of paradigm shifts, several motivated by awareness of the limitations of our planet. Our world is becoming less and less stable. The number of big disasters, whether natural or resulting from human activity (earthquakes, landslides, land subsidence, climate change consequences, etc.) is increasing. Severe weather conditions together with inadequate human interventions on the earth surface, as well as with an increase of inhabitants in several areas of the globe, are leading to a need of engineering surveys in pre, during and post disasters.

In the domain of civil engineering, rehabilitation is the new rule and sustainability in construction is an undeniable demand. Even if 2D mapping is still needed and current practise, engineers and architects look for 3D in all phases, from the design, to the construction, and throughout the operation phase. Several demand 4D models now, integrating data from several sources, sometimes in real (or quasi real) time.

The challenges are increasing. New techniques and requests in new areas of work are challenging the engineering surveyors. FIG Commission 6 will work together with engineering surveyors to provide them information about equipment and methods that will increase their expertise, making them even more valuable professionals.

## **Working Groups**

### **Working Group 6.1 – Deformation Monitoring and Analysis**

Deformation studies in Engineering Surveying are based on a broad knowledge of suitable sensors and their potential, modern data storage and communication solutions and advanced processing and analysis methods. Additionally, a thorough understanding of the behaviour of monitoring objects and processes (e.g., large scale structure or landslide effected area), is essential to set-up and operate an optimum monitoring system.

Nowadays deformation tasks are more and more oriented towards real-time, multi-sensor systems, which require automation of data capture and new concepts in data processing, analysis and interpretation.

WG6.1's main goals will be to support specialists in deformation studies with state-of-the art solutions and provide latest developments and future oriented concepts:

- Promoting studies on the potential of existing and new sensors to determine geometric deformation quantities from surveying and adjacent fields;
- Promoting the development of concepts for automated data storage, data transfer and data pre-processing;
- Promoting the adaptation of numerical algorithms to derive relevant deformation quantities in real-time, including concepts from time series analysis;
- Promoting a multidisciplinary collaboration between surveying, structural and geotechnical engineers to understand the behaviour of structures and geotechnical objects;
- Study of most modern concepts for data analysis like artificial neural networks, fuzzy logics and generic algorithms;
- Investigate and adopt as required modern analysis techniques (Big Data, IoT, etc.) to cope with large volume data arising from large number of low-cost sensors;
- Study the issues and investigate the challenges arising for using Unmanned Aerial Vehicles (UAVs) for deformation monitoring;
- Initiate investigations to extend the range of deformation studies to higher frequencies, which are important in Structural Health Monitoring, i.e. to be able to study oscillations and vibrations and their effects on critical structures;

## **Workshops/Symposia**

In 2011 a new series of symposia was created, named: Joint International Symposium on Deformation Monitoring (JISDM)

These symposia are a joined initiative of FIG (leadership), IAG and ISPRS. The objective is to bring together specialists from different fields within the geodesy, photogrammetry and surveying communities, which have interest in the here mentioned fields of deformation monitoring.

Up to now these symposia are held in Hong Kong (2011), Nottingham (2013), Vienna (2016). The next JISDM will be held in Athens in May 2019. Responsible organiser for this event is Prof.

Vassilis Gikas, the vice-chair of WG 6.1. More than 150 abstracts are submitted for this outstanding meeting!!

### **Publications (as challenge)**

Proceedings of the meetings (it is intended to have the option of peer reviewed proceedings)  
Prepare reports on State-of-the-Art (guidelines) for typical deformation tasks (e.g. dams, bridges, high buildings, landslides, rock-fall, ...);  
Comparison of concepts from artificial intelligence for deformation analysis;  
Case studies: For a typical data set of continuous observations, which has to be defined, different analysis concepts and tools have to be applied.

### **Working Group 6.2 – Landslides Monitoring**

Landslides, debris flows and rockfalls can endanger inhabitants and infrastructures. If we focus on landslides, they have an important societal impact in many mountainous, hilly and coastal regions in the world. Landslide failures may seriously damage the human and environmental resources of a region. However, it is still uneasy to forecast the evolution of a landslide because it depends both on its dynamics and on external triggering events, such as earthquakes and rainfall. This is why monitoring is essential to learn more on the physical processes controlling their movement (failure, propagation) and to attempt to predict their behaviour in time and space. Innovative investigation, monitoring and mapping techniques are being developed in order to improve the methods for local and regional landslide hazard assessment and/or the design of early warning systems.

WG6.2's main goals will be to support specialists in landslides monitoring studies with state-of-the art solutions and provide latest developments and future oriented concepts:

- Promoting studies on the potential of existing and new sensors to determine geometric deformation quantities from surveying and adjacent fields (remote sensing, seismology, meteorology, hydrology and geochemistry);
- Promoting the development of concepts for automated data storage, data transfer and data pre-processing;
- Promoting the adaptation of numerical algorithms to derive relevant deformation quantities in real-time, including concepts from time series analysis;
- Promoting a multidisciplinary collaboration between surveying, geological, geophysical and geotechnical engineers to understand the behaviour of landslides;
- Study of most modern concepts for data analysis like artificial neural networks, fuzzy logics and generic algorithms;
- Investigate and adopt as required modern analysis techniques (Big Data, IoT, etc.) to cope with large volume data arising from large number of low-cost sensors;
- Study the issues and investigate the challenges arising for using Unmanned Aerial Vehicles (UAVs) for deformation monitoring;

## **Workshops/Symposia**

WG6.2 will dialog with geological, geophysical and geotechnical organizations to promote the inclusion, in their events, of sessions or even workshops related with monitoring using surveying techniques.

## **Publications**

FIG publication on landslides monitoring by surveying methods  
Technical papers at FIG Proceedings



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