

**Report to the 31st General Assembly
FIG Working Week in Stockholm, Sweden, June 2008**

FIG Commission 6 – Engineering Surveys

Report of Activities 2007-2008

1. General

The field of interest of Commission 6 are traditional the acquisition, processing and management of topometric data and all related information throughout the life cycle of a project (at construction site), quality control and validation for civil engineering constructions and manufacturing of large objects, modern concepts for setting-out and machine guidance, deformation monitoring, analysis and interpretation, measurement of dynamic loaded structures (general), prediction of deformation and movements in engineering projects, mines and areas of geological hazard, automatic measuring systems, construction and industry and multi-sensor measuring systems, terrestrial laser systems, their usage in architecture, civil engineering and industry and standards related to the construction and deformation measurement.

The Commission 6 activities were started with creation of the Working Plan for 2007-2010 and the new Commission 6 team build by WG Chairs and Co-Chairs. Starting the new period, joint these positions 6 new colleagues, former Commission 6 delegates and members. The main topics of the Commission are covered in the former period by five WGs, which structure was completed by the sixth WG oriented for terrestrial laser scanning.

2. Working Groups

WG6.1 – Deformation Measurement and Analysis

Chair: Stathis Stiros (Greece); Vice-chair: Cecilia Whitaker (USA)

WG activities are focused on the automation of monitoring surveys, enhancement of geometrical modelling of deformations from integrated deformation surveys, physical interpretation of deformations including numerical modelling and prediction of deformations and back analysis. A main objective of this WG is to propose or improve techniques to analyze historical geodetic data in comparison with modern ones, mostly GPS-based. This is expected to permit:

- to extend the geodetic information on crustal deformation in larger time and space scales; especially to compare data collected after a certain event (for instance an earthquake) with those collected before it in areas not covered yet by extensive GPS networks.
- to examine whether the pattern of crustal deformation derived from longer term data (tens to hundreds of years) differs from the short-term one, derived mainly from modern, usually satellite data. This investigation is not limited to tectonic and seismic effects (especially the local earthquake cycle) but extends also to volcanic effects and to rather

surficial effects (for instance synsedimentary faulting in young deposits, sediment consolidation, etc).

The results obtained were presented in several meetings in Greece, Germany, France, Italy, and Turkey. In the Perugia IUGG 2007 Congress and in particular in an IAG Symposium there has been an important participation and there was much interest, especially from Japanese people.

WG6.2 – Engineering Surveys for Industry and Research

Chair: Thomas Wunderlich (Germany); Vice-chair: Peter Kyrinovic (Slovakia)

The main goal of WG activity is to provide the specialists involved in that kind of missions with the latest state of the art concerning the use of adapted survey techniques in industry & engineering, multidisciplinary collaboration between survey engineers, civil engineers, structural & mechanical engineers, R&D scientists - for a better approach of complex engineering survey problems, specific algorithms, instrumentation, equipment and techniques in engineering surveys, high precision measurements and special techniques for the large scale metrology of big equipment or structures, integration of survey & alignment sensors with actuators and/or tools for on-line monitoring and control of a given process (dynamic systems).

WG6.3 – Engineering Survey Data Bases and Facility Management

Chair: Lothar Gründig (Germany); Vice-chair: Vladimir Seredovich (Russia)

WG activity is focusing on the role of the surveying engineer as the responsible manager of spatially referenced information, support for the co-ordination of the activities of other disciplines, building concepts of data models for the mapping of relevant 4D or 5D project data, covering 3D geometry, time, and descriptive attributes, exchange, provision and presentation of facility management data in computer networks, data integration for this subject, taking into accounts the presence of redundant data and different sources of information and automation and combination of feasible data acquisition techniques.

WG6.4 – Engineering Surveys for Construction Works and Structural Engineering

Chair: Gethin Wyn Roberts (UK); Vice-chair: Joël Van Cranenbroek (Belgium)

The WG is promoting the use of adapted survey techniques in industry & engineering, promoting a multidisciplinary collaboration between survey engineers, civil engineers, structural & mechanical engineers, promoting the understanding of fibre optic sensors, e.g. interferometric sensors, study the use of embedded sensor arrays and the role of advanced surveying techniques for structural monitoring, creating an awareness of surveyors through a task force 'Fibre optic sensors' of the rapidly emerging technology of fibre optic sensors as "non-geodetic" sensors to measure deformations (strain) and temperatures in civil engineering structures.

WG6.5 – Terrestrial Laser Scanners – joint WG with FIG C5

Chair: Maria Tsakiri (Greece); Vice-chair: Rudolf Staiger (Germany);

WG is promoting the usage of laser scanning for geometric documentation in a variety of environments, particularly high risk and environments which benefit of remote measurements

(e.g. structures, slopes, underground surveys, structural deformations of cultural heritage monuments), investigate existing and developing terrestrial laser scanner instrumentation for engineering applications, evaluate and compare algorithms for processing terrestrial laser scanner data (e.g. registration, surface modelling, etc.), investigate and document metrological and quality control issues for laser scanning measurements, investigate the integration of laser scanning measurements with other measuring techniques, such as conventional geodetic systems and photogrammetric techniques.

The special and actual topics in focus of Com 6 were covered by six Study Groups. Their activities were oriented to:

- SG 1 'Continuum Mechanics as a Support for Deformation Monitoring, Analysis and Interpretation', chaired by Anna Szostak-Chrzanowski (Canada)
- SG 2 'Optimal Use of Interferometric Synthetic Aperture Radar (InSAR)', chaired by Linlin Ge (Australia)
- SG 3 'Crustal Deformation', chaired by Stathis Stiros (Greece)
- SG 4 'Monitoring and Analysis of Cyclic Deformations and Structural Vibrations', chaired by Gethin Wyn Roberts (UK)
- SG 5 'Fibre Optic Sensors', chaired by Helmut Woshitz (Austria)
- SG 6 'Terrestrial-Based RF Positioning Technologies', chaired by Joel Barns (Australia)

3. Events in 2007-2008

During the year 2007 were organised events planned by WGs and their members:

- International Course for Engineering Surveying, held in Graz (Austria), April 17-20
- 8th Conference on Optical 3D Measurement Techniques, held in Zurich (Switzerland)

Both of organised events are well known between the engineering surveying community and were attended by high number of participants. Traditionally these events are focused to surveying, geodesy, machine-, computer- and robot- vision, spatial information systems from a variety of working areas (universities, industry, government) to discuss recent scientific and technical advancements and applications for optical static and kinematic 3D measurement techniques. Emphasis in both meetings was placed at new and emerging technical in laser-scanning. At the 15th International Course on Engineering Surveying (IVK) in Graz, were prepared by the WG6.2 members the Tutorial 1 (1 day) "Precision Laser Scanning"; Tutorial 3 "Tunnel Construction" (1/2 day); documentation and ppt-scripts for participants. These activities were chaired by Th. Wunderlich (Germany). Block of presentations to the topic fibre optic sensors and their usage in civil engineering structure monitoring were prepared by SG5 members, chaired by H. Woshitz (Austria).

Traditional are organised by FIG C5 and C6 and commission for Engineering Surveying and Photogrammetry of the German DVW the seminar for Terrestrial Laser Scanning, which was held in Fulda, Dec. 5-6 2007. The Session 1 "Data Acquisition", was prepared by the WG6.2 of the FIG C6.

WG6.4 and SG4 participated with joint session at the international conference organised by UK's Institution of Civil Engineers' and the 5th International Conference on Current and Future Trends in Bridge Design, Construction and Maintenance held in Beijing in China, September 17-18, 2007. The purpose of this conference was to provide a forum for bridge

practitioners and researchers to share their experiences and understanding, to highlight notable successes and to ensure that progress is maintained. The programme was designed to be as wide-ranging (including bridge monitoring) as possible so that all might benefit.

Commission 6 was represented at the FIG WW in Hong Kong by three sessions devoted to deformation and land slide monitoring and special engineering applications. It was organised two joint events of Com 6 and Com 5 devoted to terrestrial laser scanning. Traditional annual meeting of the commission was held during the WW, during this were discussed actual topics of deformation monitoring, analysis and interpretation using continuum mechanics, monitoring and analysis of crustal deformations, optimal use of InSAR technology, terrestrial-based RF positioning technologies, methods and equipment of terrestrial laser scanning for engineering surveying procedures, analysis of cyclic deformations and structural vibrations, monitoring of dynamic loaded structures, application of automatic measuring systems for machine guidance, setting-out and measurement of deformations, multidisciplinary expertise and co-operation, which lead to integrated survey methods and systems, co-operation with other professional organisations (IAG, ISM, ISPRS, etc.).

4. Co-operation with international associations

According to the increasing co-operation between FIG and other professional organisations Commission Chair Prof. Kopáček attended the XIII Congress of the International Society for Mine Surveying in September 2007 in Budapest (Hungary). Papers and presentations were prepared for the XXI Congress of ISPRS held 2007 in Beijing (China) in co-operation of the joint WG5 for laser scanning. Many of the WG and SG members are active in different IAG commissions.

5. Future events

For 2008 are 6 conferences and seminars planed:

- The 13th International Symposium on Deformation Measurements in Lisbon (Portugal), which is prepared for May 2008 by the WG6.1 and SG1, SG2, SG3 and SG6 together with IAG C4. The annual meeting of SG5 will be held in Lisbon during the conference.
- The 4th International Conference on Engineering Surveying – INGEO prepared by the WG6.2 members will be held in Bratislava (Slovakia) in October 22-23.
- In Novosibirsk (Russia) will take place the 4th International Exhibition and Scientific Congress GEO-SIBERIA 2008, which is parallel devoted to the 25 anniversary of the Siberian State Geodetic Academy. This is co-sponsored by FIG C6, namely by WG6.4.
- The 1st International Conference on Machine Control & Guidance prepared by ETH Zurich (Switzerland) will be held in June 2008, with participation of the WG6.2 and WG6.5 members.
- The seminar on Terrestrial Laser Scanning in Fulda, will be held in November 6-7, 2008. This will be organised by C5 and C6 of the FIG together with the DVW.

Commission 6 will participate at the FIG WW in Stockholm by technical sessions devoted to the engineering survey topics and the commission annual meeting build space for presentation of the progress made by the commission WGs and study groups. The high number of prepared events underlines, that the year 2008 will be the most active and very important for Commission 6. The effort included to this events and their preparation will transform to

results, which are important not only for commission members, but all specialists dealing with engineering surveying around the world.

Prof. Dr. Alojz Kopáček,
Chair of Commission 6
April 2008

Commission web site: www.fig.net/commission6