

## Measurement of Dam Deformations: Case Study of Obruk Dam (Turkey)

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In the literature, there is information regarding the first deformation and displacement measurements in dams that were conducted in 1920s Switzerland. Today, deformation measurements in the dams have gained very different functions with improvements in both measurement equipment and evaluation of measurements. Deformation measurements and analysis are among the main topics studied by scientists who take interest in the engineering measurement sciences. The Working group of Deformation Measurements and Analysis, which was established under the International Federation of Surveyors (FIG), carries out its studies and activities with regard to this subject.

At the end of the 1970s, the subject of the determination of fixed points in the deformation monitoring network was one of the main subjects extensively studied. Many theories arose from this inquiry, as different institutes came to differing conclusions. In 1978, a special commission with representatives of universities has been established within the FIG 6.1 working group; this commission worked on the issue of determining a general approach to geometric deformation analysis. The results gleaned from the commission were discussed at symposiums organized by the FIG. In accordance with these studies, scientists interested in the subject have begun to work on models that investigate cause and effect relations between the effects that cause deformation and deformation.

As of the scientist who interest with the issue focused on different deformation methods, another special commission was established within the FIG engineering measurements commission in order to classify deformation models and study terminology. After studying this material for a long time, the official commission report was published in 2001. In this prepared report, studies have been carried out by considering the FIG Engineering Surveying Commission's report entitled, 'MODELS AND TERMINOLOGY FOR THE ANALYSIS OF GEODETIC MONITORING OBSERVATIONS'.

In October of 2015, geodetic deformation measurements were conducted by considering FIG reports related to deformation measurements and German DIN 18710 Engineering Measurements norms in the Çorum province of Turkey. The main purpose of the study is to determine optimum measurement and evaluation methods that will be used to specify movements in the horizontal and vertical directions for the fill dam.

For this purpose;

- In reference networks consisting of 8 points, measurements were performed by using long-term dual-frequency GNSS receivers for duration of 8 hours.
- GNSS measurements were conducted in varying times between 30 minutes and 120 minutes at the 44 units object points on the body of the dam.
- Two repetitive measurements of real time kinematic (RTK) GNSS were conducted at the object points on dam.
- Geometric leveling measurements were performed between reference and object points.
- Trigonometric leveling measurements were performed between reference and object points.
- Polar measurements were performed between references and object points.

GNSS measurements performed at reference points of the monitoring network for 8 hours have been evaluated by using GAMIT software in accordance with the IGS points in the region. In this manner, regional and local movements in the network can be determined. It is aimed to determine measurement period which will provide 1-2mm accuracy that expected in local GNSS network by evaluating GNSS measurements performed on body of dam. Results will be compared by offsetting GNSS and terrestrial measurements. This study will investigate whether or not there is increased accuracy provided by GNSS measurements carried out among reference points without the possibility of vision.