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ONLINE DATA PROCESSING IN THE PROCESS OF BUILDING DEFORMATION DURING THE PHASE OF RENOVATION

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Abstract: *In this paper a new system is actualized, with completely modern metering stations, which can perform automatic measurements for online monitoring. The measurement data can be stored and transmitted by the observation object with software situated the office (office), where processing and data processing are presented virtually online. This system, to monitor the deformation process of the building during the renovation phase is installed in an old building on the outskirts of Vienna. In this paper we will present a concrete example, to serve as an alternative to similar cases.*
Key words: Processing of data, 3D coordinates displacement, alarm system, automatic measurement and Conducting, GOCA-system.

1. Reviewed object

The building in which the online-monitoring system is installed (Figure 1) consisting of three floors and basement, dates from 1887.

Fig.1. Former kaserma and cutting it Reduction of the central wall

Fig.2. Cracks in the basement wall

It is built of stone and tile material which is habitable. The building has two side walls and in the middle a central wall, which has a drop/sinking up to 15cm. The reduction of the wall has caused cracks in the basement (Fig. 2) and on floors, especially on the first floor, where the difficulty is closing the doors and windows.

Damages set forth in the apartment show significant sinking and ongoing sinking in the central wall. These descents are likely to have been incurred over the last decade. Approximately 20cm below the foundation of the basement flows underground water. The first assumptions confirm that the first appearances of damages are due to refraction of the foundation. A change in load or underground will likely affect the partial or complete demolition of the building. For this a renovation concept has been developed in order that the common foundation of the central wall becomes stabilized. In order to do the renovation of the central wall by segments, as well as to guarantee the safety of the occupants of the building and the workers themselves during the construction process, it is essential to continue ongoing monitoring measurements which shall be performed 24 hours online. In the monitoring process the alarm system (fig.3) is also set up. During the works, a suitable emergency plan is available for evacuating residents of the building.

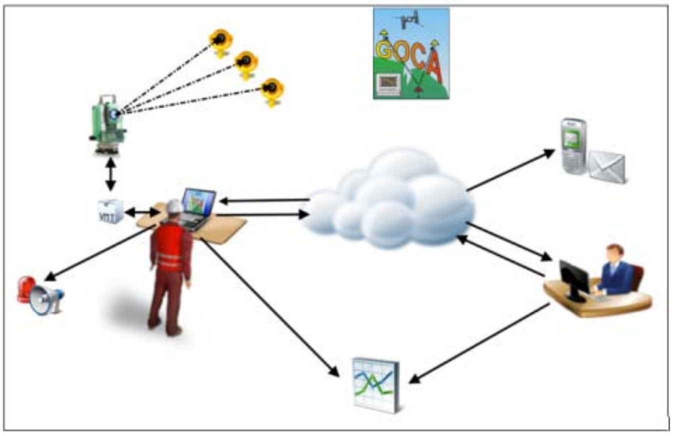

Fig.3. Schematic view of the system for monitoring

2. Implementation of measurements

To measure movements / deformations in a particular area or object, in most cases, independent geodetic networks are developed, from which surveys are carried out. In some specific cases it is necessary that these movements are followed online, which are likely to be realized by using measuring stations which are totally motorized/ robotized [1]. Collection of data through measuring stations in combination with computer and relevant software for data processing represents a great potential in measuring and monitoring of deformations.

In the market there are different software for this purpose such as Goca (GNSS / LPS / LS-based Online Control and Alarm System). This software has even the Accompanying unit named VMT / TCP / IP-Box which automatically directs the measuring station by observing set points, single ones, provided in time series, collects the data which are sent from the gauge station to the computer [2].

2.1. Development of the geodetic net

The Geodetic Network was developed as a free net, in order both to avoid the mistakes of the existing grid reference. The network has five points: three inside and two outside the scope object (fig. 4 red).

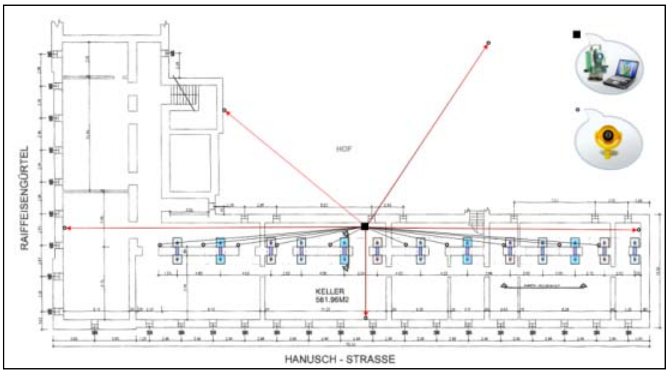

Fig.4. Various components of the system [5]

Before starting work at the facility precise measurements are made to determine the coordination of these points which will serve as the basis for calculating the absolute coordinates of the object points. For this reason, the console is located in the side wall of the building in order to enable a stable condition "without movement" in the gauge station. Its location is chosen so that this station includes all surveillance points in the object and the network reference points. Before beginning the survey, the gauging station has undergone a calibration and rectification control [3].

2.2 The survey of object points

The surveillance points to which 3D-deformations are monitored are signaled with prisms (with orange (fig. 5).

Fig.5. Gauging station and signaling points

In total 13 points are signaled with which the entire central wall is included, located in specific locations. The so called line or zero age is calculated by the observed reference points and object points in three series and will be the reference for all future measurements. 3D-coordinates of all points are calculated in the local coordinate system with the help of GOCA-software. In the initial stage of work surveillance measurements were made 24-hours without interruption. After analyzing the data and calculating the 3D-coordinates (displacement vector) it has been found, that the movements are not dangerous and do not represent oscillations that would cause alarm activation, something which has resulted in a series of observations in a cycle of half an hour. Measurements were carried out only in one series, while the gauge cycle lasted about 6 minutes. The end result of the surveillance series is the difference in 3D coordinate-dependent, at zero age measurement. The analysis of the deformation has been performed with the GOCA-software [5].

3. Results

For a concrete graphic overview of the state of deformation, 3D visualization of survey data is necessary. On the basis of these reflections as well as on the basis of data processing and analysis it can be verified that in which parts of the object are the particularly large displacements or how some parts of the object move relative to each other. At fig. 6 3D-deformations are presented of all observed points.

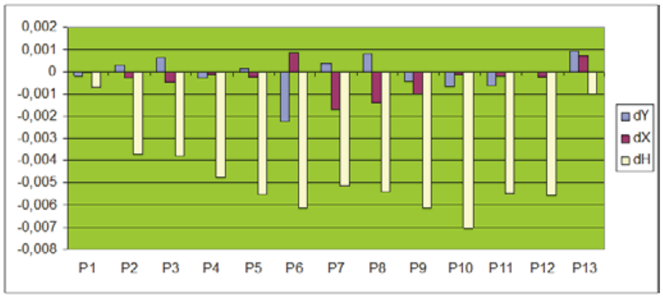

Fig. 6. 3D coordinates of points change

From fig. 6 it is clear that the height (H) has had a significant reduction of points which are located between the object (about 7mm) whereas two other components (XY-position) which had minor changes. In Fig. 7 are shown graphically all observable points with their component (H), which clearly shows the decrease of the mid points.

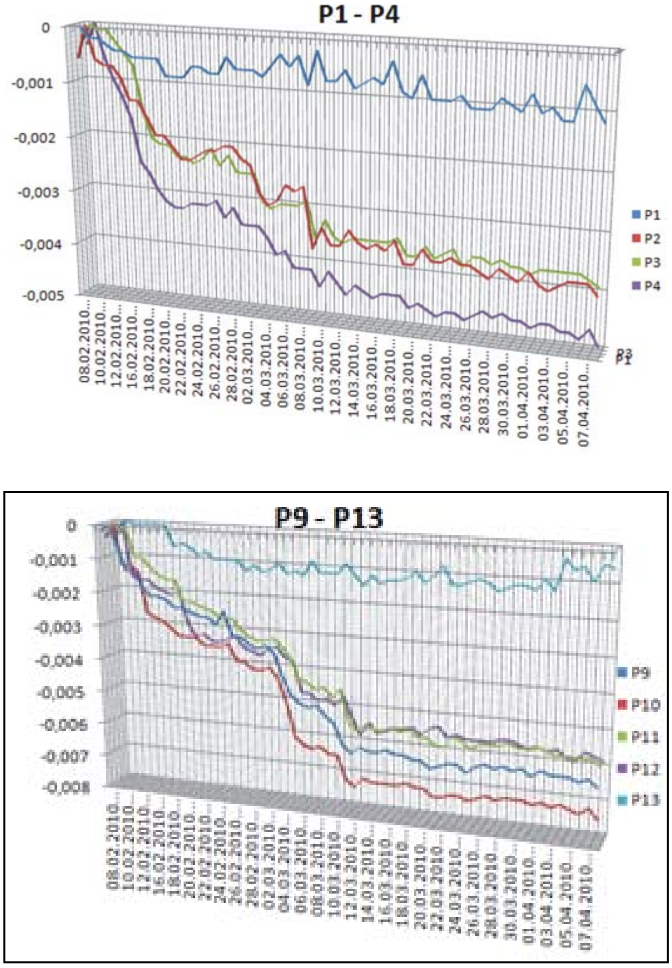

Fig. 7 Difference of the height points P1-P13

Online measurement of sizes (HzVD) was carried out with Leica TCRA1101plus. On-line visualization of the analysis of deformation measurements, and the management of the alarm system implemented by software-GOCA. Goca-system enables, that at any time we have access to information and universal access to the monitoring system itself. Requirements for an "online monitoring" are growing.

References

1. Michel, V., Person, T., Kasser, M., 2003. 74 Motorized Tachometers Aiming at 5350 Prisms in Amsterdam: The Largest Topometric Continuous Real Time Monitoring System in the World? Proceedings of FIG Working Week Paris, France.
2. Jäger, R., 2008. FuE-Projekt GOCA (GNSS/LPS/LS-basiertes Online Control und Alarmsystem) - Ein Beitrag zum Monitoring, Analyse und Vorhersage im Katastrophenschutz und zur Grundlagenforschung in den Geowissenschaften. Forschung aktuell. Hochschule Karlsruhe – Technik und Wirtschaft 1/2008. S.41-46.
3. Kahmen, H., 2005. Vermessungskunde. Verlag Walter de Gruyter, 20. Auflage, Berlin.
4. Pelzer, H., 1985. "*Geodätische Netze in Landes-und Ingenieurvermessung*" Verlag Konrad Wittwer, Stuttgart.
5. Kabashi, I., Ragossnig-Angst, M., Jäger, R., 2011. "*Geodätisches Online-Monitoring von alten Bauwerken in gefährdungskritischem Zustand im Zuge von Sanierungen*" 16. Internationale Geodaetische Woche, Obergurgl, Austria 13-19. Februar 2011.
6. Jäger, R., Müller, T., Saler, H., Schwäble, R., 2005. *"Klassische und robuste Ausgleichungsverfahren"* Wichmann Verlag Karlsruhe.
7. Pllana, G.: *"Projektimi me aplikimin e kompjuterit (dispensë)"*, FIM, Prishtinë,1997.