TRACKING BEHAVIOR OF HYDRAULIC STRUCTURES.CASE STUDY – VALEA DE PESTI DAM JUD. HUNEDOARA

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Abstract: *Taking into consideration the strategic importance of barrages and accumulation lakes, watching the behavior of the hydrotechnical construction is an essential activity throughout its entire life. A very important component of this watching is represented by tracing the shiftings of the bench marks, set for this reason, both horizontally and vertically. As a particular case there will be presented the Valea de Pesti Barrage, which was watched from the point of view of the horizontal and vertical shiftings, since its construction until present, obtaining shifting graphics for each bench mark, graphics from which an anticipation of this hydrotechnic objective behavior can be done.*

Key words: *hydraulic structures, dam, hydrotechnical construction, Valea de Pesti Barrage*

INTRODUCTION

Large hydraulic structures shall amend their geometrical shapes over time , and position in space, as a result of various factors : the variation of the groundwater level , wind pressure, nature of the soil foundation , the Foundation its own weight , etc. microseismic phenomena . Tracking measurements carried out on building or land on which they are located, is an important field of engineering and topography of the changes aimed geometric shape and position them relative or absolute . In what follows , it will present the case of Dam Fish Valley , Jud. Hunedoara . During the 35 years of operation , the dam was operated at normal stress , with significant annual variations , filled every spring NNR (826.50 ASL) and then cleared up for the shortfall of natural flow and requirements. Since the commissioning of 1973 measurements have been made , the empty reservoir when the initiator to afford the series of deformations which the dam reported . Interpretation of the measurements made dam surveillance requires knowledge elements that can determine the evolution track parameters . This includes progress in execution level in the lake water and air temperature , precipitation , tributary flows and defluente etc . The evolution of these external factors can also cause changes in the monitoring program . Progress in implementation is of particular importance in determining the efforts and interstitial pressures (for clay materials in the foundation and dam body) . Determined effort level in the lake and dam and foundation pressures , variation in lake level is generally much faster than the execution level variation fillings . It is therefore necessary to follow the lake level to do more often , rapid growth does not allow redistribution efforts and can lead to dangerous concentrations , a sharp drop does not allow drainage of interstitial pressure and may cause loss of stability of slopes or a works protection (retaining walls, tiles or waterproofing protection , etc. .) . Highlighting the daily variation is therefore necessary to verify compliance with the operating instructions and the organization of visual observations and measurements in areas where sudden variations may occur . Outside temperature variation affects the work of concrete and metal elements . Seasonal variations in temperature affect both the relative displacements measured displacements (clips dilatometer) and absolute displacements (surveying) . Very cold periods , which exceeded the previous variation, leading to the opening of joints and cracks , and the emergence of new cracks.

Operation evacuators interstiţionale pressures can influence in the area could lead to material drives and erosion and hence the movement of building elements .

Therefore it is necessary to keep track of the number of officials in the discharge, type of closure, the site debuşare , record arresters operation is organized according to the number of existing arresters .

Stability of slopes:

The lake has natural slopes well wooded . There have been reported instability phenomena during operations .

The dam area is executed maintenance (deforestation of forested areas for good visibility spotted geodesic) . Dam structure is as well .

Openings joint between two concrete elements show similar seasonal variations with variations in air temperature , but phase shift more or less important .

External requests (level in the reservoir , air temperature and precipitation) for assessing dam and its supervision are carried out with the following measuring devices and specific .

Minimum water level in the lake was recorded in 1978 with a value of 792.70 ASL (other lows : March 18, 1993 with a value of 796.20 26.11.1990 with ASL and ASL 798.20 value) .

The lowest average was in 1985 with a value of 813.28 ASL .

Levels ranged between 827.25 mdMB shares (2004 -November) and 792.70 ASL (1978). Annual maximum levels fall within a very small range: 826.60 and 827.25 mdMB very little over the odds NNR (826.50) .

Naturally, the minimum or medium shows large variations .

It is noted after 1990 an increase in the annual average , due to a decrease in water requirements .

Year 2003 shows the lowest level of annual changes throughout the operating level in the lake stayed virtually constant.

The air temperature has great importance for the safety of the dam , it is important for the aging suffered mask and increases flow analysis of existing drains in the dam footprint . Precipitation are also important (nature and timing of rainfall melting solids) .

Recorded rainfall values characterizing the geographical area and the height of the dam is , rainfall distribution is uneven .

Annual precipitation ranged between 398 mm and 1224 mm , with an average of 762 mm. Monthly peaks had values between 82 mm and 328 mm (July 2005).

The highest values were recorded in summer (over 200 mm) . When the flood occurred in August 1999 (referred to as the largest) daily rainfall was only 71 mm , and the month totaled 144 mm.

Daily maximum value of 162 mm was recorded in July 2005.

MATERIAL AND METHODS

Geodetic studies started in 1973 by executing the original series , and have continued to the present , usually with one series of observations in each year, except for the period 1985-1990 .

Objective is to design both space geodetic equipment tracking and tracing nivelitică .

Valley dam fish movements and deformations are tracked using geodetic network , which comprises the following :

- 12 Landmark Station ;

- 2 guidance cues ;

- 7 Highlights nivelitici fundamentals ;

- 12 Highlights of study space ;

- 17 Highlights nivelitic study ;

- 50 Highlights of transport nivelitic

Measurements supplied equipment was used according to the specific measurements of deformations applied to this objective. Thus, there was used :

- Total Station LEICA TCR 802, adaptive reflective device and forced centering bolts and pillars network .

- Level Leica DNA 10

The brush with the development in the area decreased visibility beneficiary landmark building in 1996 located 13 Portal Gallery spilled landmark nivelitic guidance and support , and 4 landmarks located in the home set access valves , flush the shaft collar .

Azimuthal direction measurements were performed in 10 of pilasters network , namely P1 , P2, P10, P11 , P6 , P7 , P8 , P9 , P12 , P13 , with four series of 3-15 10cc tolerance based visas . The distance measurements were carried out on an automatic correction of the influence of temperature and air pressure of 7-8 measurements for each distance from the same measurements as in the standstill directions.

Nivelitice measurements were performed on the canopy and the polygonal network links reperii support. Observations were made with four determinations , two horizons niveleu , left and right readings surprised with the acceptance of 0.05mm on niveleu carts .

The equipment used was previously corrected and verified before the start of geodetic observations .

RESULTS AND DISCUSSIONS

Processing measurements recorded in the field was conducted under a set of special computer programs (TOPOSYS) create networks planimetric results show horizontal deformations of the building . To calculate the vertical displacement using the bundled software Leica DNA level 10 .

Block rigorous processing was performed in several steps by testing the network stability and quality measurements.

Through an analysis of both travel time and planimetric nivelitice , the current lens emphasizes small movements , proving its good stability .

As mentioned in the previous study , low precision of the last series was influenced by improper materialization signaling and spotted , and obstruction of visas between pilasters network . In this case the conclusions of these studies are repeated optimization as in previous studies , by issuing these visas obstacles and marking a landmark study and pillars , pilasters especially 1, 2 , 5 and 6 . Making these deforestation is necessary to make the most urgent before the next step .

CONCLUSIONS

Network composition enables the development of these types of response to requests on three main areas:

- Mal mal left - right (X) ;
- Upstream - Downstream (Y) ;
- Slump (Z) .

Generally displacements measured geodesic has a tendency to stabilize .

Regarding geodetic to maintain safety solutions interpretation requires that around geodetic points (pillars , benchmarks) while pointing not appear due to the leakage of wastewater .

Maximum subsidence during 1973-1999 is 74.3 mm to 130 benchmark on canopy fits generally within the normal range of this type of dam , leading to the conclusion that the fillings were well compacted rockfill runtime.

Maximum horizontal displacement of commissioning after 20 years of operation was 21.2 mm , being well below the allowable limit , and this is in the section from the left bank to the canopy .

Horizontal nature of these movements is a residual plastic deformation under load due to the release of the dam, elastic deformations resulting from changes in the level is very low , close to the precision measurement survey and so basically hard to say .

Reports were made to the initial series , the first three years were consumed approximately 50% of total subsidence , and in the first 10 years about 70-90 % .

Maximum subsidence is recorded in the canopy , but also three of the downstream berms odds : ASL 813 , ASL 796 , ASL 782 and plan their distribution is normal considering the asymmetry valley with steep left bank and right bank slower.

In the period 1973-2005 , and are carried out a series of measurements and geodetic 36 , generally annual intervals . Distribution along the crest of vertical displacements results in different series of measurements leads to the conclusion that the settlement is proportional to the section height as normal.

For reperii berms downstream of the three phenomena are similar , the continuous appearance of curves showing normal behavior .

Vertical displacements are as normal, maximum canopy - 78.9 mm in the direction of old white where fillings have higher height (R130) .

Displacements in the longitudinal direction of the dam antisymmetric aspect normally directed towards the valley (R050) .

Horizontal movements showed a slight deformation trend downstream .

Shifts left bank , right bank stabilization present trends .

In general most of the profiles analyzed present plan trips max 22.3 mm in the direction OX , overall global and relative displacements are small and within the normal behavior of the dam.

As a final conclusion we can say that the fish Valley Dam is within the normal operating so far and also is expected that in the absence of extraordinary events and repeated dam will behave normally. Planimetric displacements and subsidence values tend to decrease each year due to the so-called phenomenon of stabilization of dam displacement values tending to 0 .

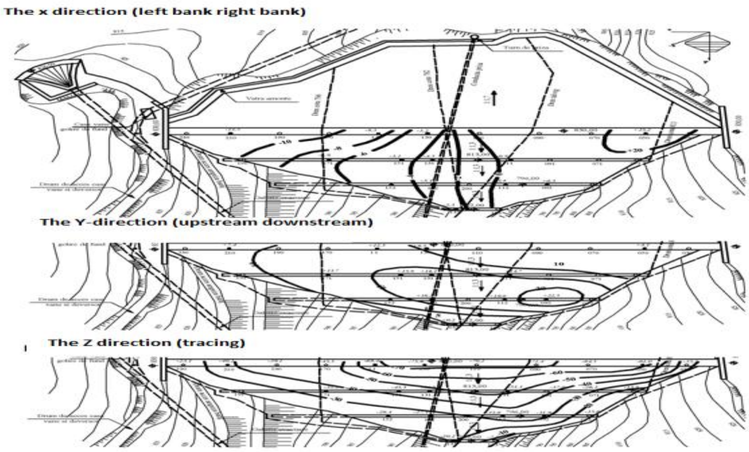

Fig. 1 Chart horizontal displacements

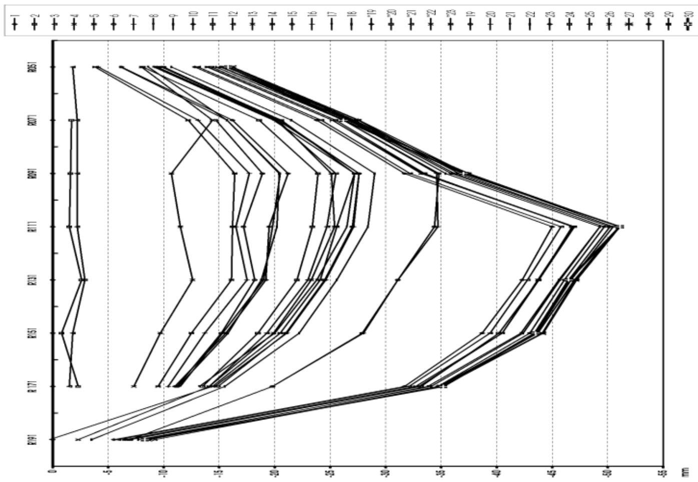

Fig. 2. Vertical displacement graph berm

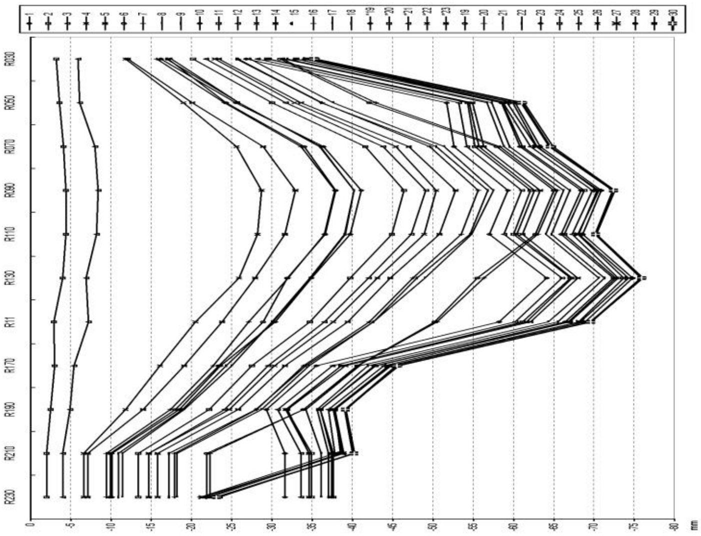

Fig. 3. Graph displacement vertical canopy

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