European Journal of Research Development and Sustainability (EJRDS)
Available Online at: https://www.scholarzest.com
Vol. 3 No. 12, December 2022
ISSN: 2660-5570

OBSERVATION SUBSIDENCY AND HORIZONTAL DISPLACEMENT OF HYDRAULIC STRUCTURES

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Article history:

Received: 1st October 2022
Accepted: 4th November 2022
Published: 10th December 2022

Abstract:

The main purpose of geodetic observations is to observe the moderation of subsidence and deformation of hydraulic structures. Hydraulic structures require constant geodetic observations.The issue of evaluating the best outcome of the determination of subsidence and deformation based on the results of geodetic measurements is of great importance. The solution to problems such as precipitation and horizontal displacement of the upper and lower slopes of the Talimarjan reservoir was considered important and urgent

Keywords: Reservoir, Water Resources, Plots, Dams, Hydraulic Structures, Deformation, Subsidence, Displacement, Deflection Of Reservoirs, Hydraulic Leveling Network Of The I-III Category, Hydrotechnical Triangulation.

INTRODUCTION

Hydrotechnical structures are built for the purpose of supplying water to residential areas and industrial enterprises, irrigating fields, discharging used and collected water, and using water energy. Hydrotechnical structures include weirs and dams, pipelines, mine and ditch aqueduct structures, embankment strengthening structures, reservoirs [1].

Deformation, subsidence, displacement, deviation of the Talimarjon reservoir located in Kashkadarya region have been monitored for many years. Deformation is a slight change of hydraulic structures over time due to their vertical or horizontal displacement or deviation from their position due to various reasons. Deformation can occur during the construction period or during the period of use after the construction is completed. Monitoring of deformation is carried out from time to time depending on the type of structure and the nature of the change. For this, a special area is allocated near the structure, where a rapier and strong signs are installed.

A geodetic marker fixed on a place for a long time by a special device is called a geodetic benchmark. The word benchmark is derived from the French language (repère) which means a mark, target, starting point in geodesy.

Talimarjon reservoir can store more than 1.5 billion cubic meters of water. More than 200,000 hectares in agriculture can be used for irrigation. The structure of the building is unique. The length of one reservoir is 1.5 km, and the second one is more than 10 km.

MATERIALS AND METHODS.

There are two plots in the Talimarjon Reservoir, and the subsidence and horizontal displacement of the upper and lower banks of the reservoirs are observed based on geodetic measurements with full-scale geodetic instruments. Determination of the deformation of two plots is carried out as a result of annual observations, triangulation and polygonometry of the 1st, 2nd, 3rd category, leveling of the1st category of the observations of points.

Deformation values are calculated based on the results of two cycles. Geodetic observations of the first period are carried out in March-April, that is, when the water volume in the reservoir rises to the maximum, and the second period of observations is carried out in October-November, when the water volume in the reservoir decreases to the minimum level. The analysis of the results of the two periods shows that a difference of 2-30 mm was found in the subsidence.

The 16-km route was leveled based on hydrotechnical leveling network of the I category to monitor the subsidence and horizontal movement of the upper and lower banks of the Talimarjon reservoir. In the same way, based on program hydrotechnical leveling network of the II category of about 30 km of the highway was carried out.

In the 2nd plot of the reservoir, the horizontal displacement of the reservoir with a length of 1.5 kilometers was determined by its points. In the same way, leveling works were carried out from the marks on the edges of the upper and lower banks. The appearance of the reservoir is analyzed twice a year based on the results of measurements.

Geodetic monitoring of the subsidence and horizontal movement of the reservoir is considered based on the rules of technical operation. The development of the deformation detection method has more scientific and industrial significance.

RESULTS

DETERMINATION OF SUBDIVISION OF PLATE №1 OF TALIMARJON WATER RESERVOIR. To monitor the subsidence and horizontal displacement of the reservoir, two rows of subsidence marks were laid on the upper and lower banks. There are 67 stamps on the upper bank and 65 on the lower bank. These sink marks are leveled based on III hydraulic leveling program. The leveling grid is leveled based on three reference points located at the beginning, end and middle of the reservoir, 1,5-2 km outside the deformation area of the leveling points of 1st category **(Fig.1.).**

Sinking marks consist of 8 closed polygons, and the marks are placed on the edges of the reservoirs by hydraulic leveling of the 1st degree. Bush benchmarks have 3 main benchmarks, each of which is laid in the ground at a depth of 2.5 m, and they are located at a distance of 60-80 meters from each other. Equalization of leveling of the I and III category is carried out based on program. Analysis of leveling results in two periods showed edge subsidence of 3 – 27 mm. As a result of comparing the subsidence of the upper and lower shores in two periods, the analysis of the leveling results shows that the subsidence of the points of the upper and lower shores was 10-25 mm.

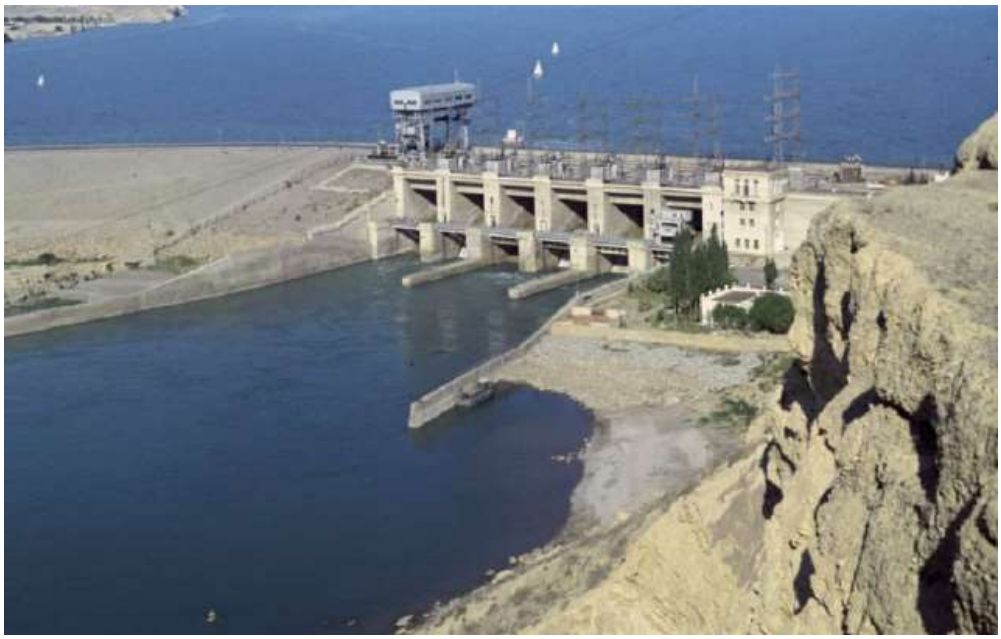

Fig.1. General view of Talimarjon Reservoir

DETERMINATION OF HORIZONTAL MOVEMENT OF PLATE №1 OF TALIMARJON WATER RESERVOIR.

A special hydrotechnical triangulation of the upper parts of the plot was developed to determine the horizontal subsidence of the points of the plot (Fig.2). Hydrotechnical triangulation of the I category was built in the form of a geodetic rectangle located at a distance of 1,5–2,5 km. The horizontal angles are changed from 23° to 90°. 5 points of triangulation are constructed outside the deformation zone. All points of triangulation were marked with a special geodetic symbol. Base sides were measured with a range finder. Horizontal angles were measured 15 degree, 8 in the morning and 7 in the evening. Mean square error of angle measurement is 1″–1,5″. The weakness of the triangulation is estimated with a relative error of 1:150 000.

The calculated horizontal displacement of the triangulation points shows that they have changed by 10–30 mm. The main difficulty in performing the work is the angle measurement performed at the triangulation points and determining the horizontal displacement of the edges of the points located between the triangulation points. The results of the angle measurement are performed at a certain interval

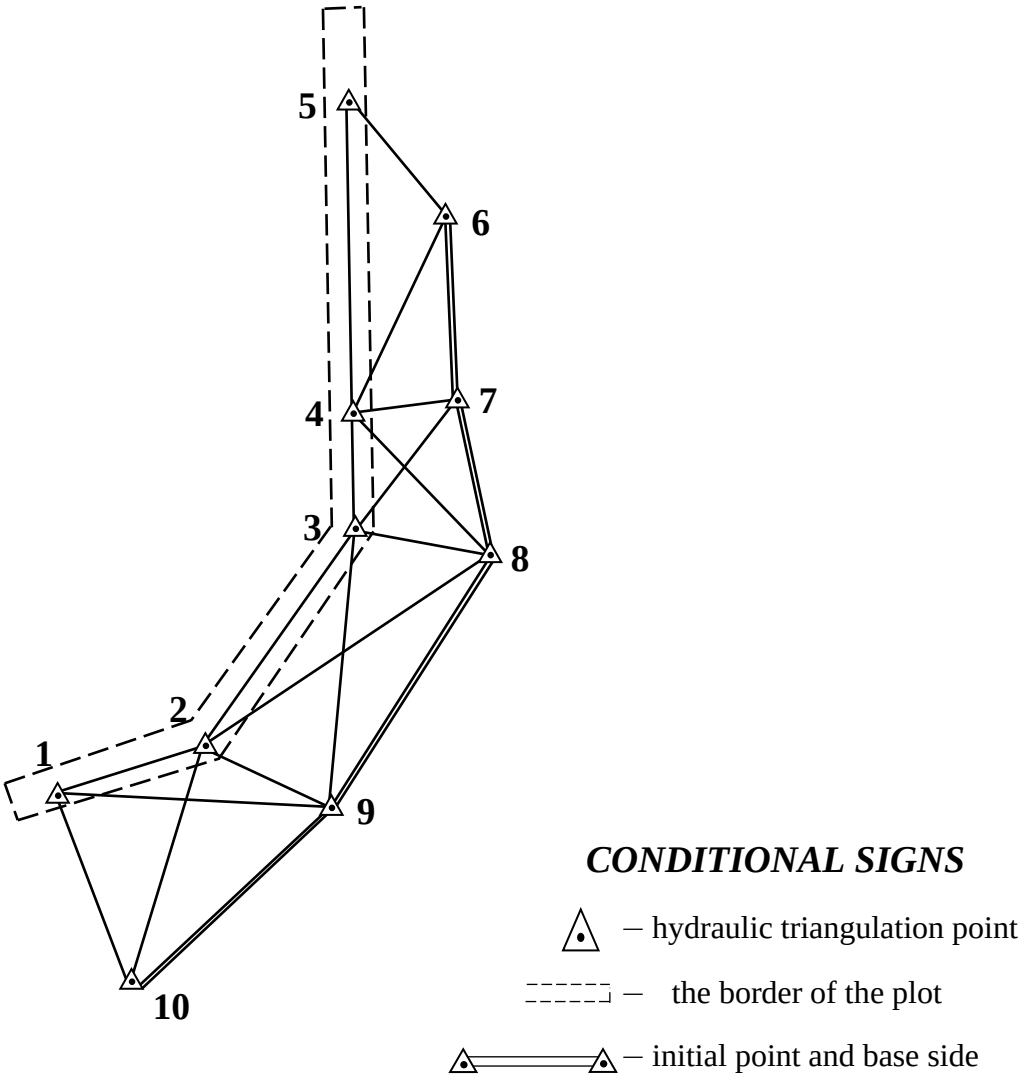

Fig.2. Hydraulic triangulation of the Talimarjon reservoir

DETERMINATION OF THE HORIZONTAL MOVEMENT OF PLATE №2 OF THE WATER RESERVOIR. Hydrotechnical leveling of the II category is carried out between two bush benchmarks. They are located 0.8-1.0 km from the end of the plate, and the bush benchmarks are located in the outer area of the deformation.

Mark towers hardened on the ground with concrete were carried out based on program hydrotechnical leveling of the II category. The results of sedimentation calculated in two periods showed a difference of 2-19 mm.

Angular measurement is performed on theodolites or total stations, the mean square error is 3″, and the distance is measured on the range finder.

Determination of horizontal displacement is performed on the basis of polygonometric observations in two periods, points are placed on the vertices of the plot, and horizontal displacement of 3-30 mm has been proven.

The results of the fourth geodetic rectangle triangulation failed because the angle values gave an unacceptable check. It became necessary to build an additional point in points IV and V.

Geodetic measurements determination of horizontal displacement and subsidence of the 2nd plot was carried out by polygonometric marks. All measurements are done according to project requirement. It should be noted that the calculation process was performed on the basis of a special computer program.

CONCLUSION AND RECOMMENDATIONS.

Geodetic measurements were carried out with geodetic instruments in the Talimarjon reservoir. Determination of the deformation of two plates was carried out by geometric leveling, leveling of the I, II,III category and triangulation and polygonometry of the I category observation of points. Deformation values were calculated based on the results of two periods and a difference of 2-30 mm was determined. The analysis of the results of the two periods shows that the results of the fourth geodetic rectangle triangulation failed because the angle values gave an unacceptable check. It became necessary to build an additional point in points IV and V.

Geodetic measurements determination of the horizontal displacement and subsidence of the 2nd plot was carried out by means of polygonometric signs. All measurements are done according to project requirement. It should be noted that the calculation process was performed on the basis of a special computer program.

As we noted above, we said that the deformation, subsidence and horizontal displacement of the Talimarjon reservoir through geodetic measurements was carried out in two cycles. Geodetic observations were made in the first period in March-April, when the water volume in the reservoir increased to the maximum, and in the second period in October-November, when the water volume in the reservoir decreased to the minimum level.

In conclusion, it can be said that the results of two periods of the first plot show that all the point paths gave the expected settlement. Less subsidence was found at points 15,17,19,22,39,55,61,67,75,94,55–1,55–2. It did not show more than 10 mm of subsidence at these points. In the results of observation, there were many sunken points: 49 – point was 35,3 mm, 91 – point was 26,7 mm. This means that, points on the top of the plot are points of stable character. The upper and lower banks are made on the basis of hydraulic leveling of the II category.In the first quarter of the year, subsidence occurred in the right and opposite directions during field surveying. Corresponding corrections have been made and equalized. First of all, hydraulic triangulation observations were made. The results of the observation serve as initial information. The height of the stamp depth is given in Fig.2. Heights are used as a initial point. Analysis of the second plot shows that the points on the upper bank are stable, while the points in the middle of the plot are displaced mainly in the direction of the water pressure. All sinking brands are proven to sink 1-25mm. The horizontal displacement of the reservoir is 4–28 mm [5].

Deformation monitoring is continued from the beginning of the construction of the structure until the first years of its use. In this case, it is tried to carry out observation steps at the same intervals. After the structure reaches its full load, the settlement monitoring period changes. Further observations are carried out 4, 3, 2 and 1 times a year. After completion of the construction, the foundation of the structure is observed, if the base of the foundation consists of clay soil, it should be carried out for about 5 years, and for sandy soils, it should be carried out for 2 years. In general, it is recommended to monitor the settlement of the structure until the base of the structure is completely stabilized, that is, until the values of the settlement of the structure according to the results of the last three periods of observations fall within the leveling accuracy limit. Observations are carried out once a year in hydraulic structures even after their foundation is solid.

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