IMPROVING THE MEASUREMENT METHOD ON THE OVERALL ALIGNMENT PROGRAM

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The method of measurement by optical alignment is based on the measurement of narrow angles (deviations of control points from alignment) with the help of optical theodolite and fixed sight mark. This measurement method is applied on a big number of hydraulic engineering structures. The objective of works: to improve the measurement method on the program of overall alignment. For this purpose was applied the reference method with the use of total station and fixed prism reflector for determination of HPP dam alignment. In the result of performed experiments it was possible to reveal significant efficiency and informativity of the method, approved by obtained data in cameral processing by using the command of "parallel size" in AutoCAD software. The conclusion is made that, the reference method lets coordinate alignment points with the required accuracy and more efficient productivity, which helps perform measurements to overall alignment for more than 1 km by the method of "successive intervals".

Key words: optical alignment, overall alignment, narrow angles method, reference method, hydraulic structure, production experiment, the results, alignment points, AutoCAD, successive interval.

REFERENCE

1. Karpik, A. P., & Stefanenko, N. I. (2009). Evaluation of Sajano-Shushenskaja dam condition in the period of normal operation using geodetic measurement data. *Izvestiya Vuzov. Geodeziya i Aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 5, 3–10 [in Russian].

2. Jambaev, H. K. (1986). *Vysokotochnye stvornye izmerenija [High-accuracy measurements]*. Moscow: Nedra Publ., 264 p. [in Russian].

3. Skripnikova, M. A. (2010). Application of automated high-precision total stations in measuring deformations of engineering structures. In *Sbornik materialov GEO-Sibir'-2010: T. 1, ch. 1 [Proceedings of GEO-Siberia-2010: Vol. 1, Part 1]* (pp. 131–134). Novosibirsk: SGGA Publ. [in Russian].

4. Scientific report No. GR 0198.0004957. (2004). Observations for settlements and horizontal displacements of concrete hydraulic structures of Novosibirsk HPP. A. P. Karpik (Head), & B. N. Zhukov etc. (Executors). Novosibirsk: SGGA Publ., 46 p. [in Russian].

5. Rechitskii, V. I., & Pudov, K. O. (2014). Refined model of the concrete dam at the Boguchanskaya HPP based on field observations. *Power Technology and Engineering*, *47*(6), 393–399.

6. Code of Practice SP 47.13330.2012. Engineering site investigation for constructions. Basic statements. Retrieved from ConsultantPlus online database [in Russian].

7. Standarts Russian Federation. (2014). GOST R 55260.1.9-2013. Hydraulic structures. Safety requirements for exploitation: national standard. Moscow: Standartinform Publ., 30 p. [in Russian].

8. Code of Practice. (2012). Geodetic works in construction. Updated version of SNiP 3.01.03-84: SP 126.13330.2012. Moscow: Minregion Rossii, 84 p. [in Russian].

9. Savich, A. I., Bronshtein, V. I., Groshev, M. E., Gaziev, E. G., Lliyn, M. M., Rechitski, V. I., & Rechifski, V. V. (2013). Studies on the static and dynamic behaviour of the Sayano-Shusnenskaya arch gravity dam. *International Journal on Hydropower and Dams*, *20*(6), 53–58.

10. Henriques, M. J., Lima, J. N., & Oliveira, S. B. (2011). Measuring of inclinations in Cabril dam: results of a test using an optoelectronic sensors. *6th International Conferences on Dam Ingineering*. Portugal, Lisbon.

11. Gorjainov, I. V. (2018). Experimental research of linear-angular back-sight application for stability evaluation of horizontal geodetic control network points. *Vestnik SGUGiT [Vestnik SSUGT]*, *23*(1), 28–39 [in Russian].

12. Sal'nikov, V. G., Skripnikov, V. A., Skripnikova, M. A., & Hlebnikova, T. A. (2018). Use of modern automated geodetic devices for monitoring hydrotechnical constructions of hydro power stations. *Vestnik SGUGiT [Vestnik SSUGT]*, *23*(3), 108–124 [in Russian].

13. Sholomickij, A. A., Lagutina, E. K., & Soboleva, E. L. (2017). High-accuracy geodetic measurements in deformation monitoring of Aquapark. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 45–59 [in Russian].

14. RD 153-34.2-21.342-00. (2001). Method for determination of safety requirements for hydraulic structures. Moscow, 24 p. [in Russian].

15. User manual V.5.5 Leica TS06. (2005). Heerbrugg, Switzerland: Leica Geosystems AG, 215 p. [in Russian].

16. Gutov, S. S., & Li, V. T. (2015). Automated Satellite System for Strain Monitoring at the Sayano-Shushenskaya Hydroelectric Power Plant. Practical Experience in its Introduction. *Power Technology and Engineering*, *49*(4), 252–257.

17. Malik, T. N. Burachek, V. G., & Brik, Ja. P. (2016). Method of full automated geodetic control of engineering structures' deformations. *Tehnicheskie nauki i tehnologii [Technical sciences and technologies]*, 1(3), 145–152 [in Russian].

18. Cranenbroeck, J. (2011). State of the Art in Structural Geodetic Monitoring Solutions for Hydro Power Plant. *FIG Working Week 2011: Bridging the Gap between Cultures*. Marrakech, Morocco.

19. Lebedev, N. A., Orlov, S. V., Sherstnev, A. F., Dudin, A. V., Karlson, A. A. (2005). Geodetic control of Bratskaja HPP structures. *Gidrotehnicheskoe stroitel'stvo [Hydraulic Engineering]*, 1, 9–20 [in Russian].

20. Vasjutinskij, I. Ju., Oznamec, V. V., Bujukjan, S. P., & Zhidkov, A. A. (2019). Some tendencies of development and objects for methods of high-accuracy applied geodesy. *Izvestiya Vuzov. Geodeziya i Aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 1, 40–44 [in Russian].

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