IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 6, June 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

Monitoring of Dousti dam during construction and operation

Mohamad heydari[1], Ehsan Motamedshariaty[2], Amir Jami khorasani[2], Nasibeh Sadat Vaziri[3] ,Mahin etemadifar[4]

[1] Masters of construction engineering and management
[2] Masters of Geological Engineering at Isfahan University of technology
[2]Masters of Geological Engineering at ferdowsi university of mashhad
[3] Masters student of Geological Engineering at ferdowsi university of mashhad
*[3] Masters of Geological Engineering at ferdowsi university of mashhad

Abstract
Try to To control the safety and behaviour of Dousti dam during construction the operation utilizes the information that was installed during instrumentation. Monitoring meant to evaluate the performance of a structure during construction and the operation phase that accommodated with the predictions of the designed time. It requires having the right information at all times, construction which requires collection of information and instrumentation readership to process them. Also the accuracy of the instrument should be checked to ensure information accuracy. With monitoring results and research of innovation process in the instrumentation data, can be possible phenomena being eroded, undermining the dam appearance and to provide the ability to prevent or reduce damages.

Keywords: Dousti dam, Monitoring, Limited components**.**

1. Introduction

Safety control and dam stability operations during utilization can be performed on a regular basis, according to the appropriate manner. Therefore, in order to control the safety of Dousti dam during utilization, back analysis of this dam was performed by instrumentation information installed in the dam structure. Monitoring is the process to evaluate the performance of a structure during the operational stage and matching it with the predictions of the designed stage.

This review requires having the right information at all times during construction of the dam needed to collect information, instrumentation readership and its process. Also the accuracy of the instrument performance should be checked to ensure accurate information. By using the results as a Monitoring in order to investigate the changing procedure of the instrumentation and data, it can be possible to show the probable phenomena being eroded, undermining the dam and to improve the ability of prevention or reduce losses.

Dousti Dam is a soily dam with vertical clayey silt core to a maximum height of 78 meters of floor and 74 meters of bedrock.

Deep line of the river border between the two countries in this location and the right wall should be approximately 30

to 40 degrees on the left wall of Turkmenistan and must be about 30 degrees on the Iranian side. The dam reservoir is pulled over with a low width. Much of the reservoir is due relatively by loose stones like shale, mudstone and siltstone on the Iranian side. Harder rocks, cliffs of sandstone, and limestone are on the Turkmenistan side. Reservoir length is about 45 km and with a width of approximately one kilometer.

Table 1. First step experimants

Position	Gravity (g/cm3)	Permeability (cm/s)	SPT	Pressure Resistance (Kg/cm2	C (Kg/cm2)	φ
River bed	1.48	6.2×10^{-4}	26	1-3	0-0.02	35
Wings valley	1.51	1.8×10^{-4}	27	1.5-2.5	0.5	25
Overflow	1.58	1×10^{-4}	22-35	1-3	0.2	28

The rock mass of the dam foundation and related structures of the Lithological views are placed in four groups. At The left wing (overflow range) marls of Abderaz Formation, Around the dam foundation at this wing Argillite carbonate of Abtalkh formation, Neyzar formation siltstone within the river bed and at the top parts insert sand stones, Limes and the Kalat Formation(table 2).

Analysis of dam foundation seepage, permeability rates according to the type of dam foundation rock without sealing arrangements have been made with the construction of cutoff. So in terms of the amount of water leaking from the dam foundation have been 8.5 million square meters per year, with the construction of cutoff it dropped about 3 million cubic meters. Geomechanical parameters of the rock units in dam structure and rock mass classification, is shown in Tables (3) and (4) respectively.

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 6, June 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

Table 2- Geotechnical parameters of the rock mass in the foundation of the dam anrelated structures

Parameter	Right wing	Rate	River bed	Rate	Left wing				Considerations
					Upper part	Rate	Lower part	Rate	
Dry/sat	732/344	8	377/88	4.5	<50	1	260	305	The rock mass upper part of left wing iranian side completely weathered and eroded rock and is contained in significant amounts of gypsum
RQD%	60	12	71	14	66	12	85	16.5	
J spacing(cm)	16	7.5	37	10	17	7.5	31	8	
J condition	S;Rough App<1mm Highly w.wall	20	S;Rough App<1mm Highly w.wall	20	Softgouge >5mm mixed by gypsum	5	S;Rough App<1mm Highly w.wall	20	
G.W. condition		12		4	wet	7	Damp	10	
Total Rate adjustment cfficient	0.9	59.5	Dripping	52.5		32.5	0.8	58	
Final Rate		54	0.9	47		32.5		46.5	

Row	Position		Lithology	Permeability	RQD %	Fractues per meter	Considerations
1	right wing		Sand ston	30-60	60	6	Rock on the surface has a high fracture, low special quality, high permeability and at a greater depth these qualities are improved
2	river bed		SILT STONE	1-5	71	3	
3	Left wing	upper	10-30 1-5	10-30	66	6	
		lower		1-5	85	3	
4	Over flow		Marl	1-3	72	2	

Table (3) Geomechanical parameters of rock units of dam structure

Kp	K° Kg/ cm^2	V	φ	c Kg / cm^2	Authorized strengthKg/ cm^2	Dynamic elasticity modulus Kg/ cm^2	Static elasticity modulus Kg/ cm^2	Compressive strength /Kg		Special WeightT/ M^3	Lithology	position
								اشباع	خشک			
-76	600		30	1.5	29	1.9×10^5	80500	24	57	2.64	Sandstone	Right wing
- 43	400		30	0.5	15	37×10^5	49600	4.5	19.5	2.2	Siltstone	River bed
-32	300		27	1	10.5	1.1×10^5	345800		14	2.3	Argillite	Left wing
-32	250		26	1	10	0.97×10^5	29700		10.5	2.35	Marl	over flow

Table (4) Rock mass classification around foundation based on RMR

ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264

The dam has six investment tool section namely 2, 3A, 4A, 9, 12 and 16 that only 4A section is reviewed in this article.

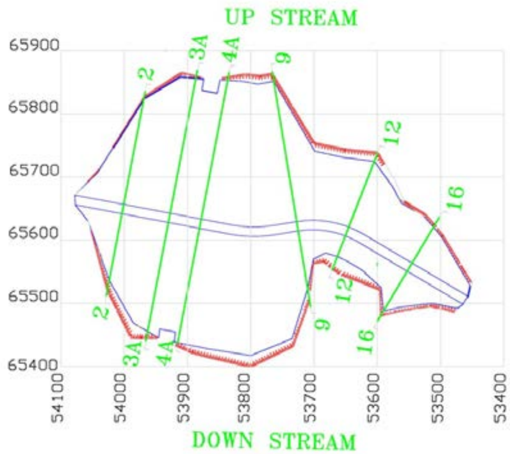


Fig1. Positions levels of investment tools Plan of Dousti

Discussion

The total stress in a section 4A

At this section, 14 total stress cells (TPC) had been predicted that only 9 in numbers of 3 groups out of 3 each at the level of 416 have been installed to check the status of the dam stress and the rest who were 5 individual were not installed nor were they abandoned during the run. Figure 2 shows the total stress changes in the cells installed.

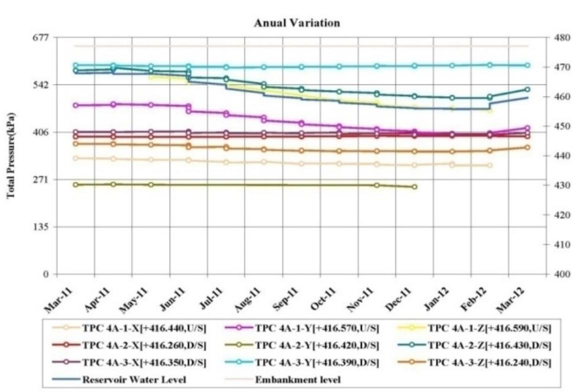


Figure 2- Long-term annual total stress changes (90) of installed TPC in 416 level Over arching in 4A section

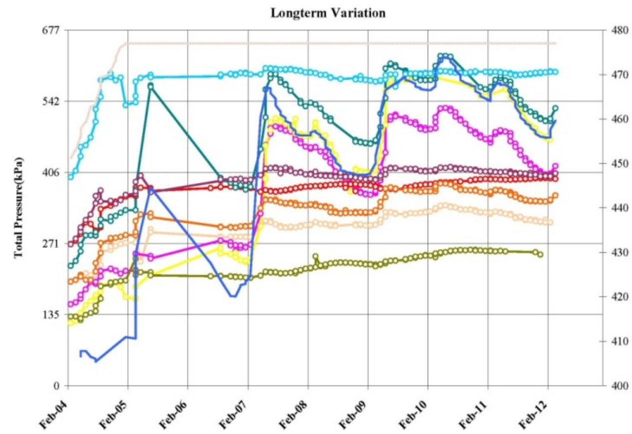


Fig3.annual total stress changes (90) of installed TPC in 416 level Over arching in 4A section

Figures 4 shows Changing of over arching ratio values for parts of dam core in 4A section that measure clusters of total stress installed there. Based on measurements taken, average over arching factor of pressure meters in 4A-1, 4A-2 and 4A-3, is 0/24, 0/30 and 0/31 respectively. Also over arching coefficients obtained from the pressure meters 4A-4, 4A-5, 4A-6, 4A-7 and 4A-8 due to Inaccuracy of pressure meters values, is not acceptable.

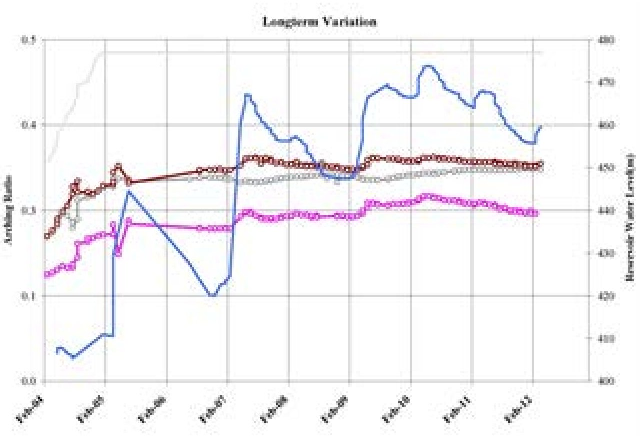
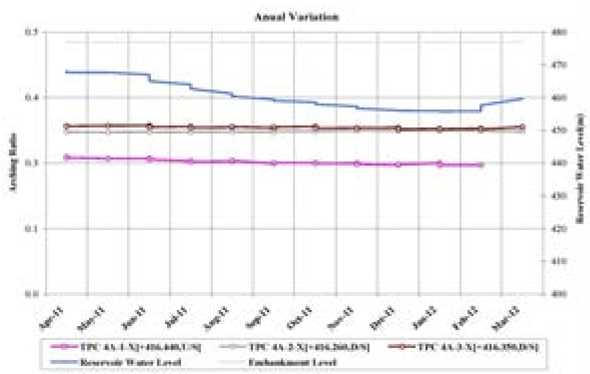


Figure 4- Arching ratio changes Over the long term l (90) in A4 section at l416 level



Evaluation of pore pressure in dam structure piezometers at 4A section

trend of long-term and annual changes (1390) Electric piezometers at 4A section from pre-installed by the end of 1390 are shown In Fig 7. Piezometers that are upstream dam nucleus and close to the skin are affected reservoir water levels. At this section, electric pizometers 1, 3 and 5 are located upstream dam nucleus. As can be seen this piezometers (except piezometer (3) is that no data) influenced reservoir Level, display pore water pressure changes.Also Piezometers that are downstream of the dam nucleus as well as pizometers 2, 4, 6 and 9 show the pore water pressure. This piezometers are unaffected bit of reservoir Level. Electric piezometer number 7 located in downstream filter of the dam and almost display zero pressure Which indicates that drainage water from nucleus with lower Level at this section enters the filter. Electrical piezometers number 10 located downstream drain and show negative pressure that it is because the water level in the drain at this section is lower than the piezometer installation Level

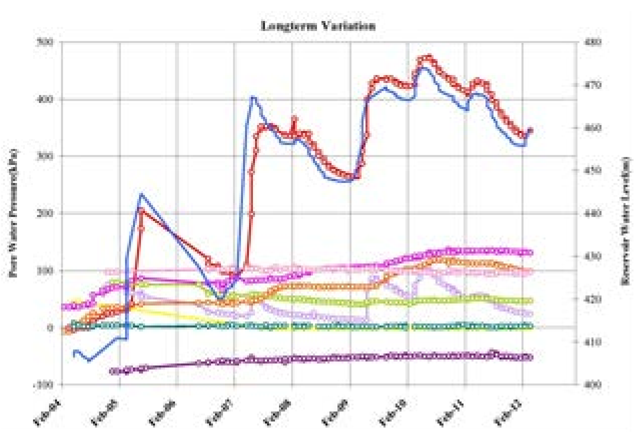


Figure 6- long-term pore pressure changes (1390) at Electric piezometer of 4A section

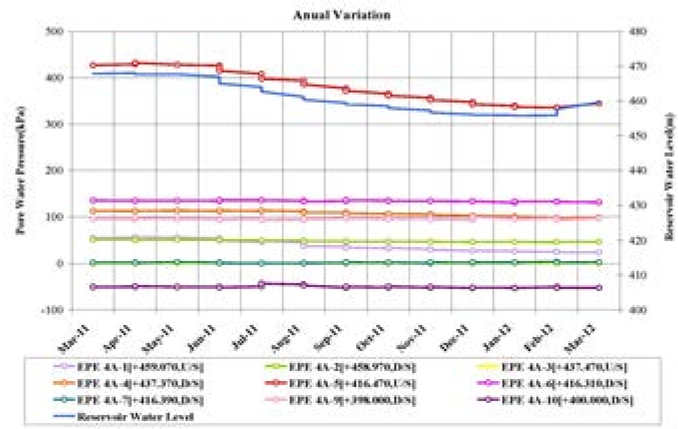


Figure 6. annual pore pressure changes (1390) at Electric piezometer of 4A section

Pore pressure coefficient (EPE) in 4A section

For piezometers located on the embankment of the dam and specially piezometers located in the nucleus of the clay, pore pressure ratio will be calculated from the ratio of water pressure to the pressure overhead.

$$R_U = \frac{u}{p}$$

"U" is pore water pressure and "p" is overhead pressure. To compare with global experience, rather than overhead pressure, vertical pressure of the soil which is equal to γH (Product levee height and weight unit) is placed.
In Fig. (7) long-term and annual (1390) changes trend of pore pressure coefficient in electrical pizometers 4A are shown from pre-installed by the end of 1390. Pore pressure coefficient for EPE 4A-5, is high which seems recorded pressure by the TPC away from reality and is very low. Maximum pore pressure coefficient for EPE 4A-6, is 0/35 and is acceptable. Due to above there is the possibility of over arching at this section. Pore pressure coefficient for EPE 4A-7 that is located at the the filter, no significant piezometric pressure, aotained zero.

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 6, June 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

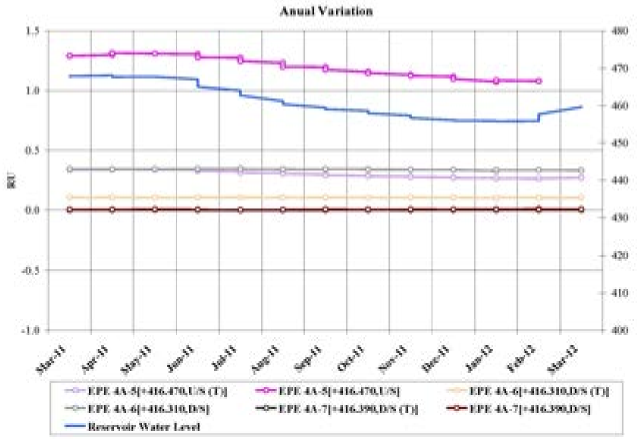


Figure 7- Long-term (90) of pore pressure coefficient in electricall piezometers of sections A

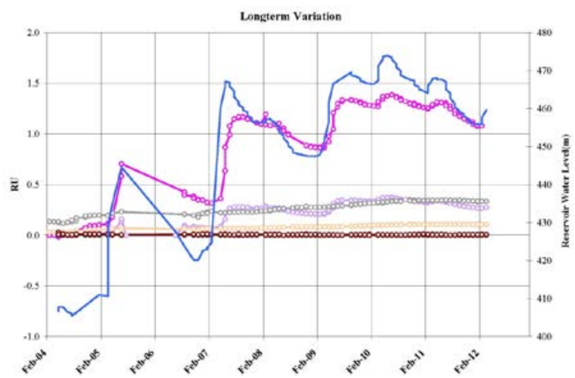


Figure 8- annual changes (90) of pore pressure coefficient in electricall piezometers of sections A

3.Pore pressure of dam foundation in cross-section 4A

In figure 9 the pressure hole in dam foundation is shown in section A4. Piezometers successive A4-1 to A4-4 without output and Piezometers A4-6 data are lacking on the 84/4/18 so far. In this section Piezometers 1 to 4 can be seen in the maps, but output has not been defined for them. Piezometer 5 also shows the negative pressures of about 70 kpa. Due to the layout of this tool there is the possibility of negative pressure. Of course there is also the possibility of leaving the calibration mode due to lack of Piezometer in another foundation at this section the pressure of this Piezometer cannot be interpreted accurately.

Figure 9- Long-term and annual changes (1390) of pore pressure in stony foundation Piezometers installed in sections A

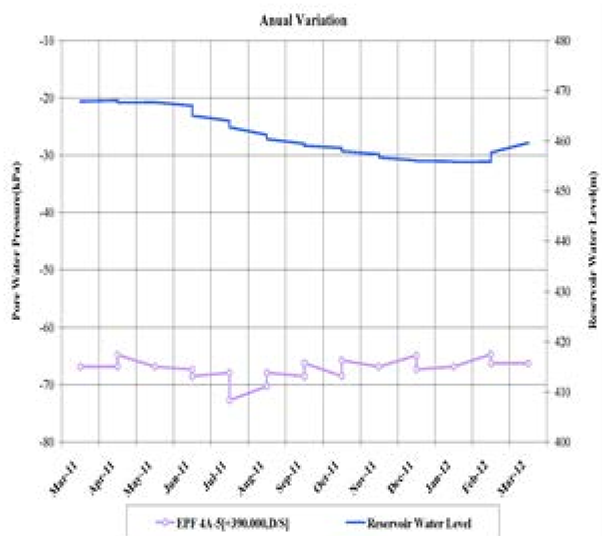


Figure 10- Long-term and annual changes (1390) of pore pressure in stony foundation Piezometers installed in sections A

Conclusion:

In section A4, the electrical Piezometers 7 which are located in the downstream of the filter show zero pressure. Due to the installation level, this pressure is acceptable. Electrical Piezometer 3 located in the upstream kernel and according to the installation level it must show pore water pressure while zero pressure is recorded. This Piezometer is probably out of calibration. "Casagrande" Piezometers 4 dry announced that possible due to the installation location. Also the coefficient of pore water pressure is very high for piezometers EPE 4A-5 . Arching factor in the installation location of this tool is low and in addition, it seems appropriate TPC, displaying the overhead pressure less than the actual value.

Acknowledgments:

Thanks and appreciation to our respected experts of Abpouy consulting engineering company because this study is part of the research process of this company.

Sources and refrences:

[1] Zomorodian and chuchi, 1391, Numerical Analysis of soily-pebbly dams behavior during construction and the first dewatering, Journal of Science and Technology of Agriculture and Natural Resources

[2] GeoStudio. 2007. Stress and Deformation Modeling with SIGMA/W. Geo. Manuals,

[3] Duncan, J. M. and C. Y. Chang.. Nonlinear analysis of stress and strain in soil. J. Soil Mech. and Found. Div.96 (5):1629-1653, 1970.

[4] Clough, G. W. and R. J. Woodward.. Analysis of Embankment Stress and Deformation. Proceedings.

[5] Paper,J.Soil Mech. and Found. Div., ASCE 93(4):529-549, 1967.