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Instability Investigate of Sarney dam abutments, under seismic loading

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Abstract: Sarney earthen dam, at a distance of 34 km southeast of Minab in the province in the study. Dam sediment structure of the division, located in the extreme western Makran zone. Dominant lithology within the catchment dam Sarney mainly of shale, sandstone, mudstone and siltstone is formed. There loose marl and shale facies in support of the dam and fault Sarney transformed prison of potential landslides in the study area. Firstly, the study was designed to collect basic information and then check the field and the data analysis was done by software Dips and Slide v.5.1. The purpose of this study was to determine the seismic zone and the maximum horizontal acceleration of the earthquake and determine the stability of the rock dam seismic loading conditions. In the rock mass surrounding the reservoir, there is also the potential slip plane parallel to the fracture event is not unexpected slip wedge. Within the reservoir, circular land sliding on the debris slope is very high. The domain area with slopes of 30 degrees in the natural state average on the right and left with a safety factor of 1.78, are stable. In the event of an earthquake with a horizontal acceleration of 0.5, with a range of safety factor will be 0.81 and are therefore unstable. Therefore, to prevent slippage of unstable mass of proposed reservoir landslide stabilization operations include reducing the slope in the form of staircase, retaining walls, and done shot Crete impermeable slopes and etc.

Key words: Sarney earth dams; Slope stability; Horizontal acceleration; Seismicity.

1. Introduction

Dams, compared with other types of dams, have the greatest number, and seismicity in the region, including Iran, to provide seismic stability of dams, is important. In fact, unstable slopes and rocky soil, and subsequent issues, one of the most common accidents, occurred in a world that is often the cause of life and property damage. Some dams, walls are unstable, the occurrence of an earthquake, flooding or dam walls will be added to the instability and cause risks, both for themselves and the structures around the dam, and sometimes the consequences of compensation inseparability from her, leaving behind. The goals of this research are followed, including the identification of Geology and Geological Engineering is the fulcrum.

Sarney Reservoir Dam in the province, 34 km southeast of Minab is a barrier to access by road to the indenture Minab is possible (Fig. 1).

2. Geological Site

Study area, the division is structured in Makran zone (Aghanabati, 2004), the dominant lithology within the catchment dam Sarney, mainly of shale, sandstone, mudstone and Siltstone with a cast made up and about more than 85 to 90% of the area covered. The rocks of low permeability with respect to the properties of the constituent materials and has no role in the storage of atmospheric loss of fertile sediment and erosion of the time are high. Conglomerate rock, red sandstone and limestone mass crystallized mainly in small and large blocks of text color mixture is exposed to low to moderate permeability and erosion have little appetite.

3. The system discontinuities

In order to identify regions of unstable fracture systems and discontinuities in the rock mass of dam foundation and bearings, joints and windows has been writing the manuscript. Accordingly, a total of 233 joints were harvested from the fulcrum (Torkizadeh and Rahnamarad, 2015).

4. Rests unconformable on the right

The fulcrum total of 153 surface discontinuities is harvested. A total of 3 sets of joint specified. The system is 65 to 90 degree slope along the 100 to 130 degrees. Equivalence curve diagram pole of the joints and the rose diagrams in Fig.s 3 and 4 are shown. Joint repetition intervals of less than 2 mm. Fig. 5 also show a picture of a cushion right.

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Fig. 1: Geographical location and the access to the dam Sarney

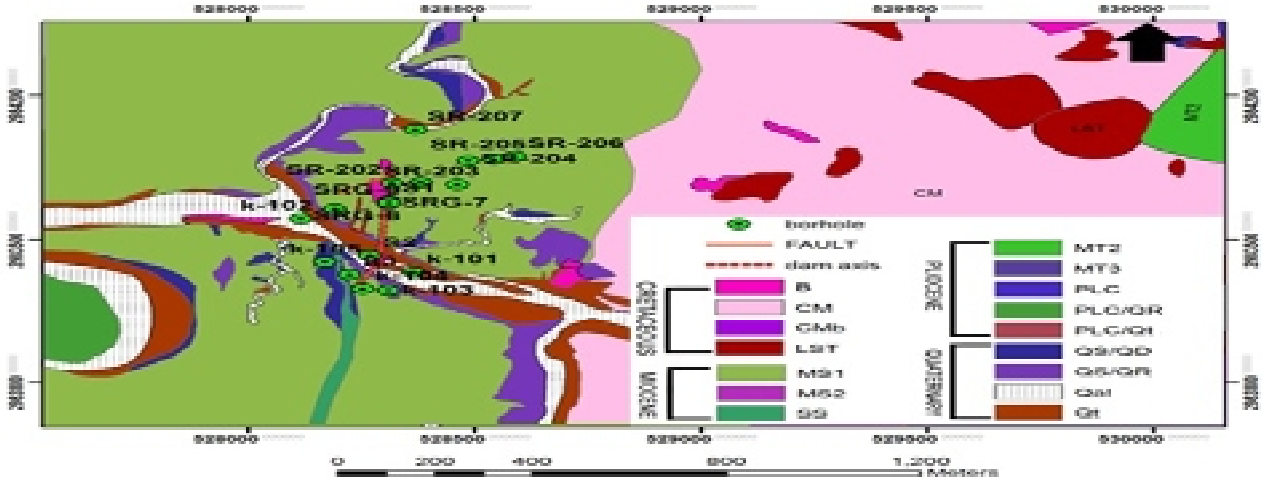

Fig. 2: Geological map of the guesswork from the geological map 1: 100,000 Tahervuei (Torkizadeh and Rahnamarad, 2015)

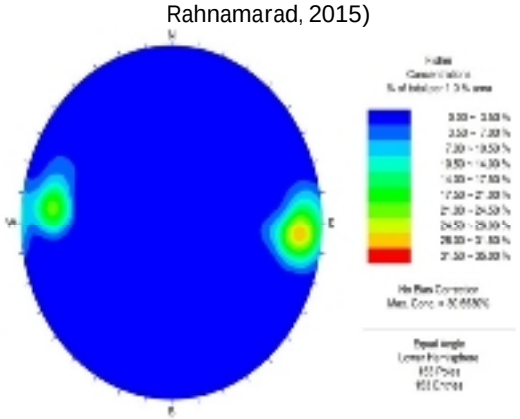

Fig. 3: The curves plot the pole rose joints on the right abutment (Torkizadeh and Rahnamarad, 2015)

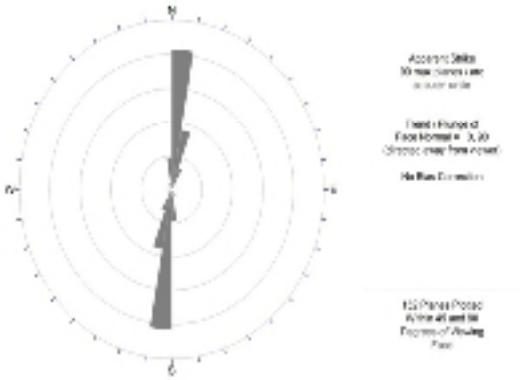

Fig. 4: The Fig. rose joints on the right abutment (Torkizadeh and Rahnamarad, 2015)

In this abutments there are several small local faults after Dam, located in the tank and can cause the water to escape. Very little evidence of fault in this area and the grounds of sex (shale, marl, mudstone, conglomerate, etc.) and partly due to chemical weathering and physical smashing units (the effect of temperature variation between night and day), there is also evidence of faults that cut the Quaternary deposits in the area is not detectable evidence of recent work in the area (Torkizadeh and Rahnamarad, 2015).

5. Rupture of the left abutment

A total of 80 surface discontinuities were picked up at the fulcrum. Filling with material discontinuities of clay, sand and clay, sand, khaki color. The left abutment joint total of 3 categories specified. The slope of 55 to 89 degrees and the system is 85 to 130 degrees. Charts and graphs pole equivalence curve rose joints in Fig.s 6 and 7 is shown. Joint repetition intervals of approximately 3 mm (Torkizadeh and Rahnamarad, 2015).

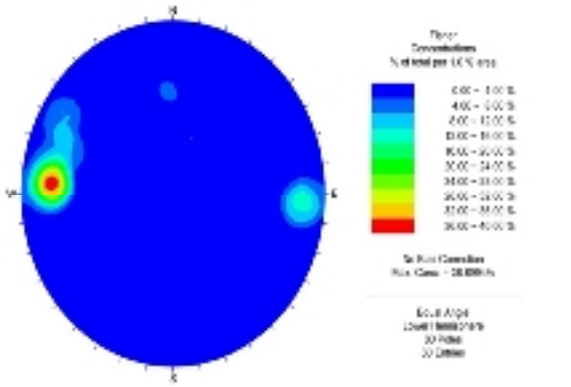

Fig. 6: The curve diagram on the left abutment joint pole equivalence

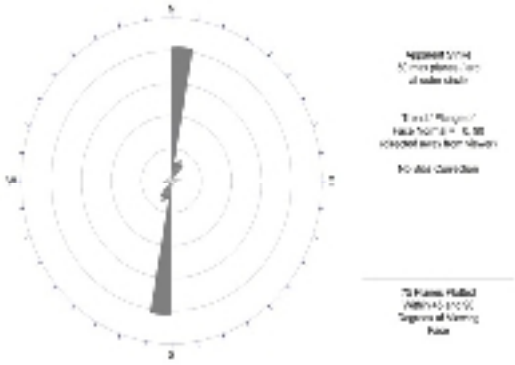

Fig. 7: The rose joints on the left abutment

6. Instability Analysis

To determine the characteristics of the implications of the discontinuity surface in the vicinity of the tank (left and right anchor block) is used. This method of writing is joint Line mapping and Window mapping. Information about the discontinuities measured at three stations (bearing right, left and reservoir area) is measured. It should be noted that in this case the surface discontinuity and rupture importance of layering, joints and fractures, tensile cracks and faults are harvested. Analyzes conducted indicate that in normal conditions, safety slip-page marly sandstone slopes of the dam is 1.71. Horizontal seismic acceleration of 0.5 g in terms of load safety factor is reduced to 0.84.

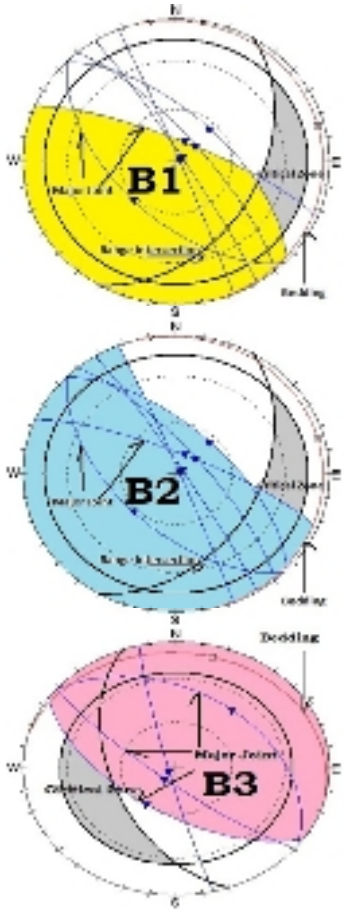

Fig. 8: Location of stone blocks, interfacial fracture surfaces and the slope of the line to the left of the critical fulcrum rock mass (B1, B2) and right abutment (B3) Sarney dam.

Table 1: Evaluation of potential slip plane in rock mass of dam Sarney

Conditions Analysis	Safety factor
Natural	*1.71*
0.5g Horizontal acceleration	*0.84*
0.59g Horizontal acceleration	*0.77*

Analysis slips with a simple circular cutting surface:

Debris fulcrum range and scope of the right and left Sarney Dam Slide v.5.1 software were analyzed. The stability of the debris impact in terms of saturation and seismic loading is analyzed. Based on observations made debris thickness in the range up to 10 meters in some parts.

Table 2: Comparison of debris on the slopes of the dam Safety factor Sarney by changing parameters.

	Safety factor					
	Dip=30 degree		Dip=40 degree		Dip=45 degree	
	Right	Left	Right	Left	Right	Left
Without seismic loading	1.379	2.192	1.005	1.187	0.501	0.931
G=0.5	0.691	1.014	0.496	0.599	1.198	0.499
With Ground water	0.271	0.857	0.402	0.493	0.164	0.370
G=0.5+ ground water	0.115	0.390	0.196	0.244	0.023	0.165

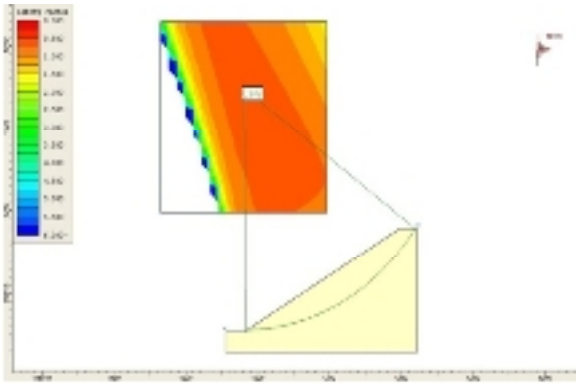

Fig. 8: Cut the circle in the debris dam right horizontal grab 0.5g. (Slope of 30 degrees).

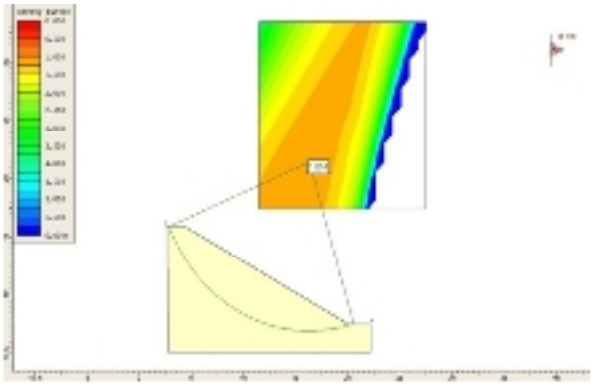

Fig. 9: Cut the circle in the debris dam left horizontal grab 0.5g. (Slope of 30 degrees).

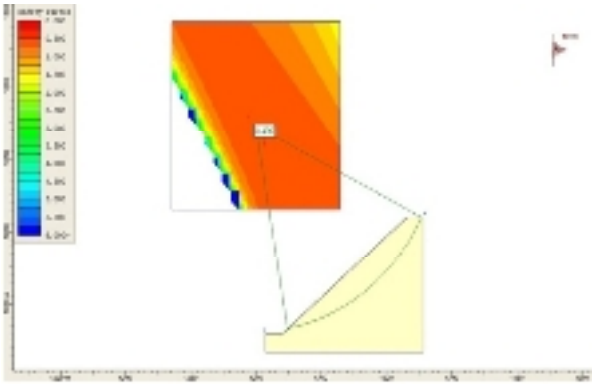

Fig. 10: Cut the circle in the debris left by the reservoir with horizontal acceleration 0.5g. (Slope of 40 degrees).

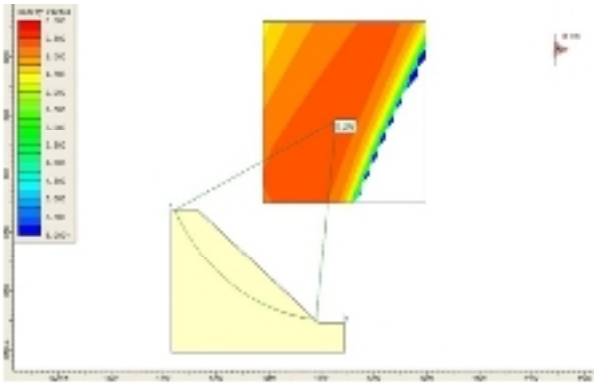

Fig. 11: Cut the circle in the debris left by the reservoir with horizontal acceleration 0.5g. (Slope of 40 degrees).

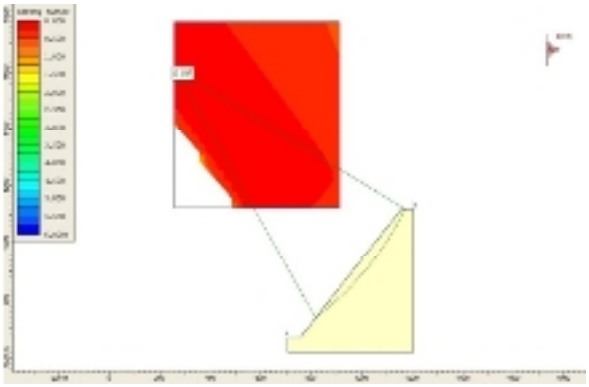

Fig. 12: Cut the circle in the right debris dam with horizontal acceleration 0.5g (slope of 50 degrees).

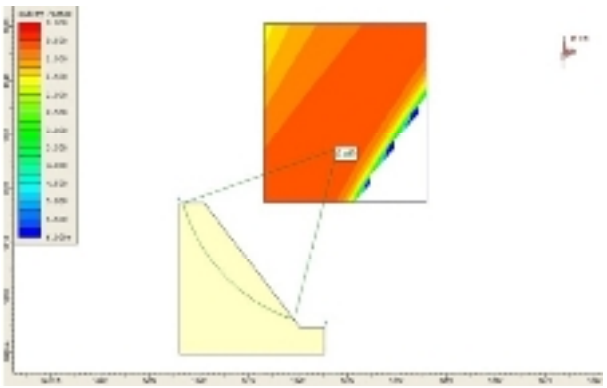

Fig. 13: Debris left on the cutting surface of a circular reservoir with horizontal acceleration of 5.0 (slope of 50 degrees).

7. Conclusion

Sarney dam reservoir area, transformed the prison and its tributaries fault zone that has been crushed to intensify activities in the region, including the loss of the landslide dam has a fundamental role.

According to the geomechanical classification, rock mass left abutment of the dam Sarney ranks poorly stones and rocks backrest are right in the category of good quality stones.

The potential barrier argillaceous sandstone rock slide plate Vgvh there. Analyses carried out indicate that the safety factor of 1.71 is the normal condition. The seismic loading conditions with horizontal acceleration 0.5g. The safety factor would be 0.84. But the potential for limited slip wedge along the interface between the stone blocks B1 is predictable.

Sarney debris slopes with a gradient of 30 degrees left and right of the dam at 1.379 and 2.192, respectively normal safety are stable. Condition in the event of an earthquake with a horizontal acceleration of 0.5g. This domain has a safety factor of 0.691 and 1.014, and the result will be unstable.

Due to the material surrounding the dam Sarney in water-saturated rock mass in contact with water unit and have the potential to slip.

References

Aghanabati, A., 2004, Geological Survey of Iran, published by the Geological and Mineral Survey, p. 586, (in Persian).

Ansarifar, M., Rahnamarad, J., Aflaki, M., 2015, Rock masses engineering classification of zarani dam site (south-east of iran), Indian Journal of Fundamental and Applied Life Sciences, 2015 Vol.5 (S1), pp. 3800-3804.

Faheem, H., Cai, F., & Ugai, K., 2004, "Three-dimensional base stability of rectangular excavations in soft soils using FEM.", Comput,. Geotech: 67-74.

Harp, E. L. & Jibson, R. W., 2002, "Anomalous concentration of seismically triggered rock falls in Pacomia Canyon: are they caused by highly susceptible slopes or local amplification of seismic shaking", Bull., Seismological Soc., AM., 92 (8): 3180-9.

Harp, E. L., Jibson, R. W., Kayen, R. E., Keffer, D. S., Sherrod, B. L., Collins, B. D., Moss, R. E. S., & Sitar, N., 2003, "Landslides and Liquefaction triggered by the M 7.9 Denali Fault earthquake of 3 November, 2002", GSA Today (Geological Society of America). August: 4-10

Ishihara, K., 1985, "Stability of natural deposits during earthquakes", Proc. 11th Int., Conf., On Soil Mech., And Found. Engrg., Vol. 1, San Fransisco, August: 321-376.

Markland, J. T., 1972, "A Useful Technique for estimating the stability of rock slopes when the rigid wedge sliding type of failure is expected", Imperial College Rock Mechanics Research Report (19): 10

Ostadmahmoodi-do, F., Rahnamarad, J., Shabanigorji, K., 2015, Engineering geology characteristics of dodaroo dam site (southeastern iran), Indian Journal of Fundamental and Applied Life Sciences, 2015 Vol.5 (S1), pp. 3813-3818.

Torkizadeh, A.A., Rahnamarad, J., 2015, Investigation of geological engineering properties with emphasis on sealing up on Sarney reservoir dam site (South East of Iran), special-issue-1-2015**.**

Zhang, Yu, Y., Hou, B., 2003, " Based stability an analysis of Nuozhadu high earth-rock fill dam", Proceedingsof the ninth Chinese national conference of soil mechanics and geotechnical engineering, Beijing: 1015-18.