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Investigation of geological engineering properties with emphasis on sealing up on Sarney reservoir dam site (South East of Iran)

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Abstract: Sarney earth dam located 34 kms south-east of Minab city, in Hormozgan Province and westend of Makran zone. Dominant lithology in the catchment area composed of the dam Srny mainly of shale, sandstone, mudstone and Sylstone. The aim of this study was to identify the conditions of geology, engineering geology of the reservoir dam foundation and fulcrum, a careful review and analysis of rock mass discontinuities, joints and fractures and to determine finally, make recommendations for water the dam. In this study, we investigate the basic data were collected during the field survey and data analysis by Stereonet, Stereograph and Dips softwares. Joint sets were identified and removed on left abutment 3. The slope of this system is 55 to 89 degrees for 85 to 130 degrees. The right abutment has three joint sets identification and harvested with a slope of 65 to 90 degrees to 100 to 130 degrees. Available geological strength index of rock mass in terms of ore block groups are weak (B/P) and the stone block and wrinkled mess with a good quality level (VB / F) takes place.

Key words: *Sarney earth dams; Engineering geology; Minab; Makran*

1. Introduction

Dams of hydraulic structures which are constructed with the aim of collecting surface water. May for purposes such as storing water for various uses, power generation, flood control are used, (Rahnamarad et al., 2013; Ghafoori et al., 2011). The issue of dam construction for water control and water storage and flood level, productive and use it during the dry season, vital and inevitable (Kockbay and Kilic, 2006). For better identification of geological and engineering geological drilling holes in the (Houlsby, 1976). To determine the geometry of the joints and discontinuities, and the opening of the joint is particularly important (Priest, 1993). The goals of this research are followed, including the identification of geological and engineering geology of the reservoir, dam foundation and anchor the reviewed results for the permeability P. Lejeune and Laufer, to drain water and provide recommendations for sealing the following the dam.

For research purposes, primarily by collecting and reviewing available information, including geological and topographical maps and aerial photographs and satellite; Information exploratory boreholes along the dam axis, Lejeune experiments, survey and field observations finally, analysis and data integration has been performed. 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

The structural division of the study area is located in the Makran subduction zone (Aghanabati, 2004), the dominant lithology within the catchment dam Sarney, mainly of shale, sandstone, mudstone and Sylstvn with a cast made up, and about more than 85 to 90 percent of the area covered. These stones, according to the characteristics of the constituent material of low permeability and has no role in the storage and the loss of atmospheric deposition and erosion of seismicity are at a high level. Stone, conglomerate, sandstone and limestone red crystallized mass, mainly in large blocks and small outcrops of colorful mix of low to moderate permeability and erodibility slightly higher (Fig. 2).

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.

3.1. Rests uncomfortably 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 Figs. 3 and 4 are

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shown. Joint repetition intervals of less than 2 mm. Fig. 5 also shows a picture of a cushion right.

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

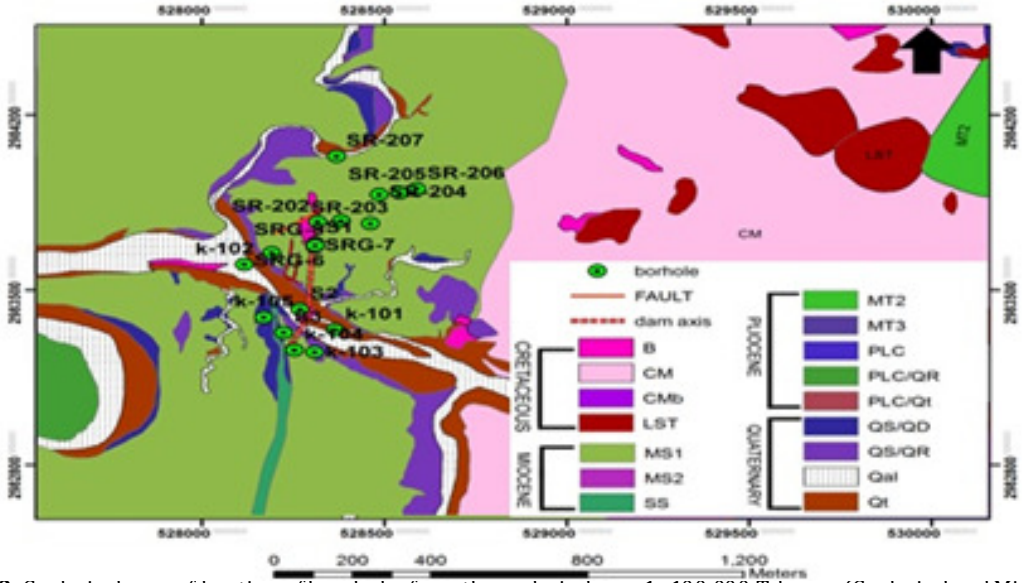

Fig. 2: Geological map of location of boreholes from the geological map 1: 100,000 Tahrvyy (Geological and Mineral Exploration, McCall, 1985)

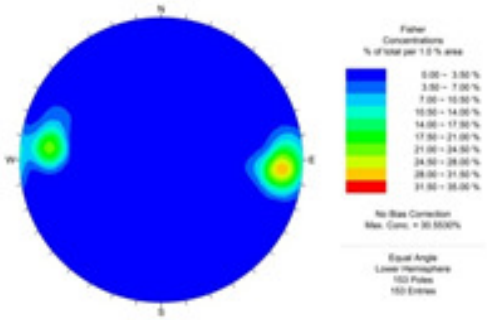

Fig. 3: The curves plot the pole rose joints on the right abutment

In this abutments there are several small local fault 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. This support is also a zigzag China is seen (Fig. 5).

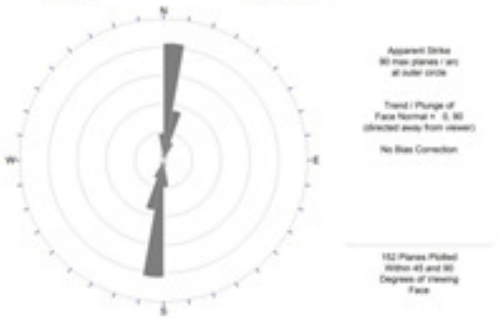

Fig. 4: The figure rose joints on the right abutment

3.2. Rupture of the left abutment

A total of 80 surface discontinuities were picked up at the fulcrum Filling with material discontinuities of day, sand and day, 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 Figs. 6 and 7 is shown. Joint repetition intervals of approximately 3 mm

Fig. 5: View of a local fault, along with a zigzag Fold

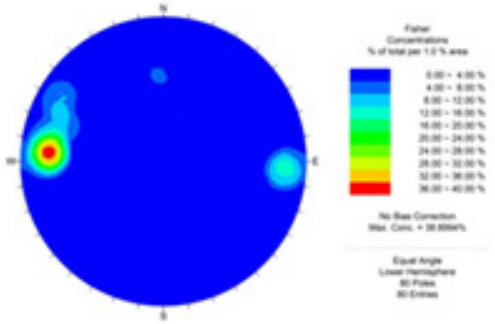

Fig 6: The curve diagram on the left abutment joint pole equivalence

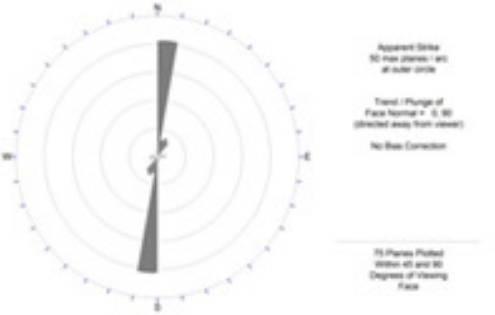

Fig. 7: The rose joints on the left abutment

4. Geological and geotechnical characterization of dam site

4.1. Evaluation of geotechnical data Dam

In order to evaluate the geotechnical parameters of the dam and its associated facilities, in the first 9 holes were drilled 325 meters in size. In the second phase of operations, geotechnical studies, 3 rings were injected in the reservoir area and 8 boreholes were drilled in the area of 237 meters.

Based on the results of the Borehole and surface impressions, on average, less than one meter thick alluvial river and materials mainly of sand and rock, with its cobblestone. A number of existing boreholes to investigate dam abutments and geological condition Thtalarzy also be studied.

4.1.1. Right

Speculation S1, 106 meters have been drilled on the basis of the results of the wear zone thickness from 3.5 to 4.5 m and an average of 55% quality index and middle class (right) is placed. Weak area of the holes S1, 13.8% of which 50% is equal to 4.5 m depth zone is worn. The permeability of the rock to a depth of 21 meters.

Boreholes K106, at the side and downstream of the dam and spillway located on the route. Zone thickness holes worn in the 13% that is placed in the category of very poor quality.

4.1.2. Left

4 holes on the left side of the site S3, K103, K104 and K105, the dam and diversion tunnel and its output is cut. Based on the results of Borehole, thick deposits of alluvial terraces of old boreholes K103 to 5 meters and materials mainly of sand and gravel and silt is sabulous with cobblestone. Penetration depth in this the range of 10 to 30 meters.

4.1.3. Riverbed

In the context of the river, three holes S2, K101 and K102, respectively dam, coffer dam and Nshybbnd been drilled. Based on the results of Borehole, thick alluvial deposits between 0.56 to 0.9 mm and the thickness of the zone to be worn in the

boreholes 2, 2 and 1.8 meters. The quality of the rock mass fraction of 45% of the old zone of more than 50% increase in the average grade gems placed. As the depth increases, the quality of the rock mass permeability increases and decreases (Fig. 8).

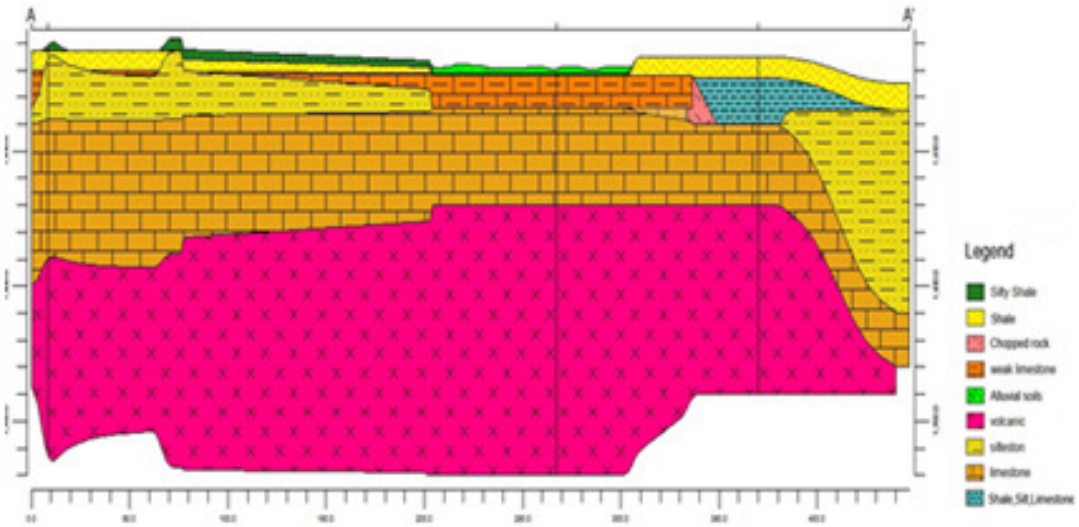

Fig. 8: The section boreholes K102, K101, K105, K104, K103S3, K106, S1 in the area and dam foundation

4.2. Coefficients geomechanical rock mass

To achieve the geomechanical properties of rocks on the number of Mghz·hhay Mghz·hhay selective recovery of the dam site Sarney exploration, laboratory tests and the results are presented in Table 1.

Table 1: Some of the geomechanical properties of the rock mass

Parameters	Mainly silty marl	Mainly sandstone
Adherence (Mpa)	0.3-0.33	0.47-0.51
Dynamic modulus (Gpa)	7.5-11	14.5-19.5
Elastic modulus (Gpa)	2.3-3.4	5.8-7.8
Modulus of deformation (Gpa)	1.6-2.2	4.7-6.3
Dry density *(T/m³)*	2.2-2.3	2.40-2.45
Saturation density *(T/m3)*	2.3-2.4	2.50-2.53
Uniaxial strength (Mpa)	1.5-1.75	4-4.5

5. Engineering classification of rock masses site

5.1. Geomechanical classification (RMR) rocks Site

To evaluate the classification of foundation and abutments have been studied boreholes. In this context, the structural properties of the rock mass containing discontinuities, faults and joints were examined. Based on the results of laboratory and field tests such as uniaxial compressive strength, RQD, permeability and discontinuity systems and their status, RMR for rock mass classification was done. The results are shown in Table 2.

The results are illustrated on the left is poor. But on the right, though, the rock mass quality, well-located within the rocks. The lithology of its surface, in such a way that it makes cement, dry conditions this wing is a good condition and in wet conditions, the average properties of the rock (III) will be reduced.

5.2. Classification of GSI

The method for determining the resistance of the geological rock mass in terms of the amount of which is determined by field observations.

6. Conclusions

The left abutment, a total of 3 sets of joint specified. The slope of 55 to 89 degrees and the system is 85 to 130 degrees.

On the right abutment, a total of 153 levels and 3 joint sets marked discontinuity impression that the system is 65 to 90 degree slope along the 100 to 130 degrees. Also, the fulcrum of the tank with rocks, marl, shale and sandstone rocks of Miocene and Pliocene conglomerate, will be in touch. The loose sediments, erosion and slope and impenetrable layers, to the upstream side.

According to the geomorphic, stratigraphic and tectonic instability expect any major attacks in the reservoir and is not expected.

Based on the results of Borehole and surface impressions, thick alluvial river bed, on average, less than one meter is that the materials, mainly sand, with rocks and boulders and boreholes have been drilled, indicates a worn and weak zone, the average

depth of 1 to 20 meters, which is the fulcrum of the riverbed, expanded. The thickness of this zone is old and weak, the abutments of the dam foundation depth and the thickness is less.

Table 2: rock mass rating system (Bieniowski, 1989)

Parameters / abutment type	Left abutment	Right abutment
uniaxial compressive strength (MPa)	1.75	4.5
Score	1	1
index RQD%	42	34
Score	8	8
discontinuity distance (m)	0.1	0.2
Score	8	8
Condition of discontinuities surface	Smooth and Soft	Rough and uneven
Score	10	25
Underground water	damp	Dry
Score	10	15
Total score	37	57
Rock Class	**IV**	**II**
Description	**Poor Rock**	**Good Rock**

Table 3: Rate of GSI stone abutments

	Left abutments	Right abutments
Score	40±5	45±5
Discrib	VB/F	B/P

According to the classification system RMR, rocks, bearing left and right, respectively, in the categories of good and poor fit.

Mass rocks, geological strength index (GSI), a group of stones weak block (B/P) and turbulent stone block and folded, good quality, the level (VB/F) takes place.

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