

## **GEOPHYSICAL AND GEOTECHNICAL EVALUATION IN PARTS OF MOSUL DAM AREA, NORTHERN IRAQ**

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### **ABSTRACT**

*An investigation of Mosul Dam area was carried out for the purpose of evaluating the geotechnical properties of foundation rocks and detection the weak zones. In this research the petrophysical and dynamic properties were determined by laboratory testing for 134 core samples from eight explored wells in the studied area. The values of effective porosity ranges between 0.1-42.0%, bulk density 1.6-2.9g/cm<sup>3</sup>, void ratio ranges between 0.04-52.91%. Velocity of compressional and shear waves range between 655.7-6746.0m/sec and 233.6- 1738.5m/sec respectively. These parameters were employed to calculate the elastic moduli and geotechnical properties of the foundation rocks.*

*The elastic moduli consists of passion's ratio ( $\sigma$ ) that ranges between 0.123-0.465, young modulus ( $E$ ) ranging between 3.65-191MPa, shear modulus ( $\mu$ ) ranging between 1.55-93.9 MPa, and bulk modulus ( $K$ ) ranging between 5.37-1085.54 MPa. In addition, the geotechnical properties are concentration index ( $C_i$ ) ranging between 1.53-10.28, material index ( $M_i$ ) ranging between -0.932-0.175, stress ratio ( $S_i$ ) ranging between 0.45-2.23, bearing capacity ( $q_u$ ) ranging between (0.159-19.6), and effective angle of internal friction ( $\phi$ ) ranging between (4.876-32.9). Maximum, minimum and mean values of elastic moduli and geotechnical properties were determined for each unit. The relationships between petrophysical, dynamic and geotechnical properties with depth are drawn, in order to determine the depths weak zones on the column section of each well. The value of elastic modulus represents as a log function of the depth.*

*The overall conclusion from those column sections is that the dam was built on weak rock unit. F-bed is the weak unit in the area due to the presence of high density of fractures, faults, fissures, and big dissolution processes with ground water percolating through may cause sinkholes. It is followed by the gypsum layer in the Lower Marl Series which also contains karstic structures such as cavities or tunnels as result of dissolution and diagenetic processes.*

*Recommendations perform a geophysical survey periodically in order to monitor and delineate the weak zones in foundation rock of dam site, to continue grouting in these zones. In addition, the propose of this investigation is to extend to the depths more than 100m, according to the results of this study that indicate the possibility of existence of cavities and weakness zones in these depths.*

**Keywords:** Mosul dam, young modulus, geotechnical properties, effective porosity, weak zones