

The effect of drilling parameters on rate of penetration in deviated core drilling

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Abstract

Today, pilot wells are used for sampling the layers of the earth during deviation drilling. In order to reduce costs and facilitate operations in situations where it is not possible to use a pilot well for coring, coring studies are carried out in a deviant manner. Investigating the effect of drilling parameters on penetration rate in core drilling of deviated wells is important to optimize operations. In this regard, the rate of penetration is studied and simulated by preparing concrete samples for coring in a deviant way with laboratory devices, so that it reaches the most optimal state with the least amount of time, along with the necessary safety. In this research, cubic concrete samples with uniaxial compressive strength of 30 MPa and porosity of 31% have been used, and the effect of these parameters on the rate of penetration has been investigated by applying various weight on bit and angles of deviation. According to the experiments, the direct effect of the weight on bit on the penetration rate until reaching the turning point and the optimal value was observed. Also, by increasing the extra weight on bit, it causes a change in the mechanism of the bit's performance in drilling and loses its tangential state and causes the small particles of the sample to be torn off, which reduces the life of the drill bit.

1. Introduction

One of the important parameters in drilling a diversion well is the penetration rate. For optimal drilling, this parameter should be examined carefully so that the drilling time and drilling costs reach their lowest levels. Weight on bit and bit rotation speed are among the parameters that affect the penetration rate. Previous researches show that the influence of the parameters of the weight on the drill and the rotation speed of the drill in vertical coring drilling will first have an increasing trend on the penetration rate and then after their optimal value, it will have a decreasing trend [5].

2. Methodology

In order to make cement samples with a uniaxial compressive strength of 30 MPa, 5 cylindrical

cement samples with a diameter of 5 cm and a height of 12 cm were made and tested with digital concrete breaker jack, and 15 cubic cement samples with dimensions of 15 x 15 x 15 cm were made for the deviation drilling test with core drilling machine. In this research, the impact of drilling parameters such as the weight on bit from 50 to 110 kg and the angle of deviation from 0 to 60 degrees on the penetration rate was investigated.

3. Results and Conclusions

By examining the results of the experiments of this research, it was clearly determined that the effect of the weight on the drill bit on the penetration rate has a direct relationship at first, and with the increase of the weight on the drill bit, the value of the penetration rate increases, and after reaching the turning point, the relationship

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will be opposite. Regarding the effect of deviation angle on the penetration rate, it can be said that by increasing the deviation angle, to maintain the penetration rate, the weight on the drill bit should be increased.

The results show that for a concrete sample with a uniaxial compressive strength of 30 MPa, which represents a soft formation, the optimal amount of weight on the drill bit in drilling operations is 80 kg, and more than this amount will change the performance of the bit in the type of formation drilling. By changing the mechanism of drill operation in the long term, it will reduce the life of the drill bit and will lead to the cost of replacing the drill bit.

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