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A Study on Behavior of Rocks Under Point load, Uniaxial Compressive and Tensile Test

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Abstract - *For evaluating the rock material for different purposes, the physio-mechanical properties of materials are the most important and key parameters. In this present study the rock material were collected from a mining quarry located in India and laboratory investigation was carried out for observing the behavior of rock under different tests namely point load test, Uniaxial compressive test and Tensile test.*

***Key Words*: Physio-mechanical properties, Point load test, Uniaxial compressive test, Tensile test.**

1. INTRODUCTION

Mineral is a naturally occurring inorganic and homogenous mixture which having definite physical and chemical composition, which are found in earth crust. The combination of one or more minerals will from a rock. The physical and mechanical properties of rocks play a major role in performance of rocks under various jobs and these properties will helps in classifying them [1]. The properties of rocks will give the information about the performance of rock under different conditions. Hence the knowledge of the properties of rock is very important for utilizing it for particular work [2]. In mining industry many accidents happen due to not having the lack of knowledge in the properties of rocks [3]. The rock strength is the one of the important mechanical properties of rock and it can be calculated by means of various laboratory investigation [6]. In this paper a laboratory investigation is carried out for finding the some of the properties namely point load test, Uniaxial compressive test and Tensile test.

Methodology

For observing the behavior of rock under different tests the rock samples are collected from various places in Andhra Pradesh, India. As the field collected samples are not in the perfect size and shape, the core specimen is drawn from the field collected sample with the help of core cutting machine which is shown in **Figure 1**. Sample preparation is the first step that need to be done in the rock testing process this helps to obtain the good results during the investigation in the lab. The prepared test samples are shown in the Figure 2

Figure 1: Core cutting machine

Figure 2: Core sample

Laboratory investigation

Point load test

In point load testing the load will act at a particular point on both the direction. In geotechnical practice this test is used for finding the strength of the rock. The information

regarding the failure strength and strength of the rocks can be known by performing this test. The prepared sample were kept in the apparatus and the diametrical load was applied on the specimen until the specimen fails. The point load testing apparatus is depicted in the Figure 3. The value at which the specimen fails will be noted and then the point load strength index was calculated by using following formula

Point load strength index =P/D 2

Where P is load at which the specimen fails and D is the Diameter of specimen

Figure 3: Point load testing apparatus

Uniaxial compressive test

The Compressive Strength of all the collected Samples are calculated by conducting Laboratory test with the help of Digital Display Compressive Testing Machine. The sample is kept on Lower plate of the apparatus as shown in Figure 4 now load is applied on the sample with the help of load applying valve the applied load will be displayed in the LCD screen so note down the reading at which the sample got failure and find out the strength of that sample by using following formula

$$Cs = \frac{\text{Load at which the specimen fails}}{Area\ of\ sample}$$

Figure 4 : Digital Display Compressive Testing Machine

Tensile strength

Tensile strength of rock was obtained from Brazilian test loading frame, having a base and a cross head joined together with the two solid pillars with nuts. At the top, the pillars have long threads for height adjustment and on the base, a 100 kN hydraulic jack is centrally fixed between the pillars. This jack has an integral pumping unit and oil reservoir. A 100 kN capacity pressure gauge is fixed to the jack for indicating the load on the specimen and an operating handle is provided with the jack. In the indirect tensile strength test a cylindrical test specimen is placed horizontally between the bearing plates of a testing machine and loaded to failure in compression as shown in Figure 5. then the tensile strength can be calculated by using following formula

$$S_t = 2P/ (\pi DL)$$

Where, S_t is Tensile strength of rock, P is Applied pressure, D is Diameter of sample and L is Length of sample.

Figure 5: Tensile testing apparatus

Result and Discussion.

The point load index, compressive strength and the tensile strength are calculated by using obtained values during the laboratory investigation and they were shown from Table 1 to table3.

Table 1: Obtained values during the laboratory investigation of Point load test

S. no	Load at which failure occurs(p)	Dia of specimen (D)	Point load strength index (Is)
1	6.25	0.07	1275.51

Table 2: Obtained values during the laboratory investigation of tensile strength

S.no	Length of rock (m)	Diameter of rock (m)	L/D ratio	Applied pressure (kN)	Tensile strength (MPa)
1	0.025	0.05	0.5	7.75	3.947

Table 3: Obtained values during the laboratory investigation of compressive strength

S.no	Length of specimen (m)	Diameter of specimen (m)	Cross-sectional area (m^2)	Load of failure (kN)	UCS
1	0.1	0.050	0.005	39.65	7330

CONCLUSIONS

For using the rock material for different purposes, the properties of that rock material are the most important and key parameters to be considered for the designing the safe and good workings. In this current study some properties of the rocks were investigated by three types of laboratory tests, namely point load test, Uniaxial compressive test and Tensile test. The following results are obtained from the performed tests.

1. The point load index of the sample is 1.27 kN
2. The compressive strength the sample is 7.3 Mpa
3. The tensile strength of the sample is 3.947 Mpa

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