STUDY OF ENGINEERING PROPERTIES OF ROCK SAMPLES FOR DEVELOPING EARLY WARNING SYSTEM

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ABSTRACT

Structural rock mechanics which concerned with the stability of engineering structures in which the material is predominantly rock. Excessive rock failure must be avoided in order to preserve the stability of the structure. Rock fracture must be induced with the minimum input of external energy. Major disasters such as dam failures and the Coal brook mine disaster; serve to illustrate the importance of rock fracture in practical engineering terms.

The advancement of civil, mining and petroleum engineering spurred interest in the measurement of rock stresses and from the relief methods of the 1930s the development of new stress measurement techniques has been constantly increasing. To estimate the movement of earthquake generating faults, we need for estimates of stress from the deep crust in rock. There are some techniques which are used for early warning fracture detection in brittle material. Infra-red radiation (IIR) and acoustic emission (AE) monitoring are the two examples of such system. But these techniques are more complex and costly hence need to propose a new technique. Rock mechanics is the theoretical and applied science of the mechanical behavior of rock. It is the branch of mechanics concerned with the response of rock to the force fields of its physical environment.

We develop a laboratory model for early indication of civil construction material rupture for some selective samples of selective size. In this model, we develop controller based system for early warning. Maximum compressive strengths of all samples are collected from civil engineering department. There are different methods used for applying compressive force on rock and on other construction material. In our system, we apply continuous unidirectional compressive force on sample under test by using hydraulic pressure. This compressive force on sample will be measured by strain gauge sensor. The strain gauge sensor output is pre-processed and will be given to controller.
Controller compares data obtained from strain gauge sensor and data regarding actual compressive strength and take decision on rupture phenomenon and gives alarm on that time.

Keywords: ***Infra-Red Radiation (IIR),Acoustic Emission (AE),Disaster, StrainGauge,Rock Compressive Strength, Mechanics.***

I. INTRODUCTION:

A civil engineer has to deal mostly with soils, rocks, timber, steel and concrete. In a great majority of civil engineering projects, soils and rocks form sites of construction directly. Rock mechanics deals essentially with behavior of rocks under applied force fields in natural as well as in laboratory conditions. Engineering properties of rocks is rather a generalized term. It might be understood to include discussion of all such properties of rocks that are relevant to engineering application of these materials either after their extraction from their natural place of occurrence or without extraction I.e.in their in –situ conditions. Failure of a material component is the loss of ability to function normally. Components of a system can fail one of many ways, for example excessive deformation, fracture, corrosion, burning-out, degradation of specific properties (thermal, electrical, or magnetic), etc. Failure of components, especially, structural members and machine elements can lead to heavy loss of lives, wealth. The survey of civil engineering works and reinforced earth structures is more and more necessary either to detect the first sign of degradation before failure or to provide the designers/owners information on the behavior of their structures. The first set would then include all those properties for which rock specimens must be tested for selection as a material of construction for example as a building stone, road stone or aggregate for concrete making. The second set of properties would include qualities of a natural bed or rock mass that would determine its suitability for a proposed engineering project.

1.1 Testing Result

Firstly sensor of 50 ton capacity is to be taken for testing.The actual compressive strength of rock samples will be calculated by 100 tonn capacity compressive testing machine.Then according to this the electric circuit will be manufactured such that circuit gives alarm at 70 percent earlier of actual compressive strength.

8 cm×8 cm rock samples of Basalt,Diorite Porphyry, Synites will be taken and actual failure at which the sample will be broken will be find out first given in table below.Minimum three Test will be taken in the final column average is given in table no.1

Fig.no.1 Rock samples with sensor mounting

Fig.2 rock samples having area (8cm×8cm)

Table no.1 compressive values of rock samples

Sr.No.	Samples	Test 1	Test 2	Test 3	Max.Average in (Kg)
1	Basalt	42000	48000	52000	47333.33
2	Diorite Porphyry	52000	68000	55000	58333.33
3	Synites	48000	62000	60000	56666.67

The table shows the average maximum compressive strength of each sample. For early rupture warning the compressive strength is of 70% of its maximum value. From above values the buzzer alarm will be started at when the first crack will be develop in the rock sample and stop at breaking point so that some timing we get the idea about alertness of the failure. The failure will be well known to us for particular type of rock.

Table no.2 compressive values of rock samples

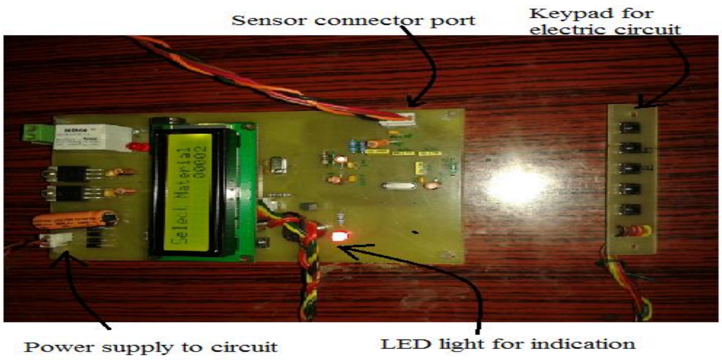
Sr.No.	Samples	Test 1	Test 2	Test 3	Max.Average in (Kg)	70%of max.Average in (Kg)
1	Basalt	42000	48000	52000	47333.33	33133.33
2	Diorite Porphyry	52000	68000	55000	58333.33	40833.33
3	Synites	48000	62000	60000	56666.67	39666.67

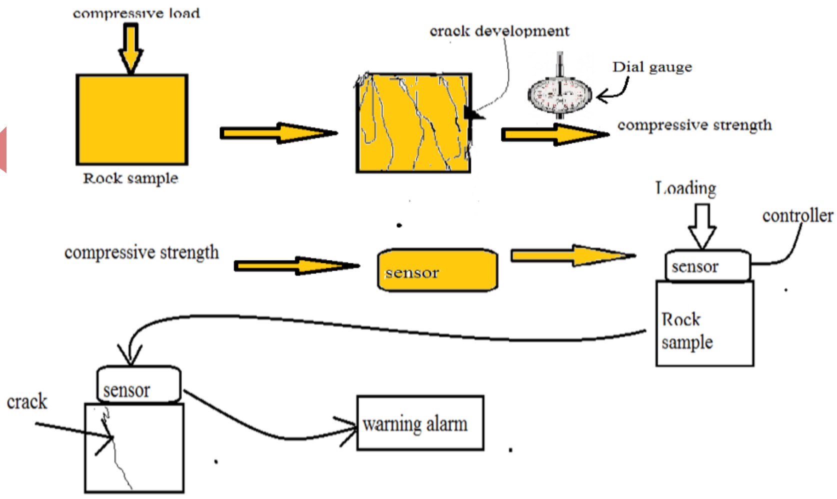
Table no.3 actual result after performing the experiment

Sr.No.	Samples	Max.Average in (Kg)	70%of max. in (Kg)	Actual alarm start during the experiment	Actual alarm stop during the experiment
1	Basalt	47333.33	33133.33	33000	52000
2	Diorite Porphyry	58333.33	40833.33	39000	58000
3	Synites	56666.67	39666.67	39000	54000

Table no.4 Actual Performance of Experiment

Sr.No.	Samples	70%of max. in (Kg)	Actual alarm start during the experiment	Actual diff.between the result obtained	%Difference between the result
1	Basalt	33133.33	33000	133.33	0.41%
2	Diorite Porphyry	40833.33	39000	1833.33	4.49%
3	Synites	39666.67	39000	666.67	1.69%





II. CONCLUSION

Following are the conclusion made on result obtained –

1) By developing such type of electric system it is observed that failure of rock sample is possible to predict.

2) It is observed that percentage accuracy is above 90%of accepted value as calculated after performing the experiment.

3) The accuracy or the performance of experiment will be depend upon the quality of sample collected it also depend upon properties of rock sample.

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