Comparison of rock samples from two different states

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Abstract: **Experimental work in the labortary found that rock failures are rare when the rock is strong and the stress is low.Some important parameters are influenced by tests in the laboratory on the mechanical behaviour of the intact structure: i) Point load test, ii) Triaxial test. These are the tests performed in the present study in order to compare the two rock samples of different states i.e. Una district of Himachal Pradesh and Jammu district of Jammu and Kashmir on the basis of testing results.**

Keywords **– Tensile strength, Compressive strength, shear strength parameters, Failure modes, stress-strain behavior**

I. INTRODUCTION

Point load strength index test is performed to obtain compressive strength and tensile strength of regular or irregular rock samples. In rock mechanics Point load test is accepted testing procedure for the calculation of a rock strength index. This index can be used to estimate other rock strength parameters. The rock strength determined by the point load test, like the load frame strengths that they estimate, is an inclination of intact rock strength and not necessarily the strength of the rock mass. The point load test is the best alternative of the UCS test because it gives same result or data at a lower cost. As per ISRM, 1985 this test was used around 30 years ago. The point load test involves the compressing of a rock sample between conical steel platens until failure occurs. Triaxial test was used for laboratory tests subjected to find the compressive and tensile strength of arches intact rocks, jointed rocks and reinforced rocks (bolted rocks).Tri-axial shear tests are conducted to obtain strength envelop, shear strength parameters of the chosen failure strength criterion, the stress-strain responses, variation of moduli and modes of failure/change in the modes of failure of rock specimens with confining pressure.A triaxial shear test is a common method to measure the mechanical properties of many deformable solids, like soil (e.g.sand,clay) and rock, and other granular materials or powders.For rock testing the sleeve may be a thin metal sheeting rather than latex.Triaxial testing on rock must be done carefully because the
high forces and pressures required to break a rock sample that required very costly and cumbersome testing equipment which is rarely available in the very few laboratories in the world.Littlejohn and Bruce (1975): conducted the first systematic study on the failure of rock bolt system and suggested three modes of failure of rock bolts system include:

- Failure of rock mass
- Failure of rock bolts and

Failure of bolt-grout-rock interface Holliugshead (1971), Pells (1974), Farmer (1975), Xucyi (1983), Aydon etal (1985), Serbousek and Singer,(1987), Aydan (1989), Singer (1990), Hyett etal (1992), Skybey (1992), Gray et al (1998), Li and Stillborg (1999), Fabyznchic etal (1992, 1998), Thompson and Finn (2001), Kilic and et al (2002, 2003), Aziz (2003), Ivanovic (2003) and Camplbell and Mould (2005) carried out the theoretical and the experimental approaches to define the bolt behavior and axial loading conditions. In majorities of the above research, the bolt profile was ignored.

II. EXPERIMENTAL STUDY

In this comparitive study of two rock masses from different states laboratory tests were chosen as the main aspect of this study.

Fig.1 shows the specimens of NX size in the cylindrical shape for triaxial testing in order to find the shear strength parameters and the values of these parameters i.e. c and ϕ the present study reports the strength of the rock samples of two different states.

Fig.1 Specimens of rock sample (HP)

Similarly, the NX size specimens are drilled from the Jammu rock sample.

The tensile strength of two different rock samples of two states is compared on the basis of the testing results of point load test; the tensile strength of the specimen can be tested

within two pointed platens of the point load testing machine as shown in fig.2.

Fig.2 Point load test

III. RESULTS

Fig.3 shows the combined stress-strain behavior of the specimens of rock sample from Himachal Pradesh figure clearly shows that if the confining pressure is high the specimen tested on that pressure attains the maximum stress and on the minimum confining pressure the stress will be very small.

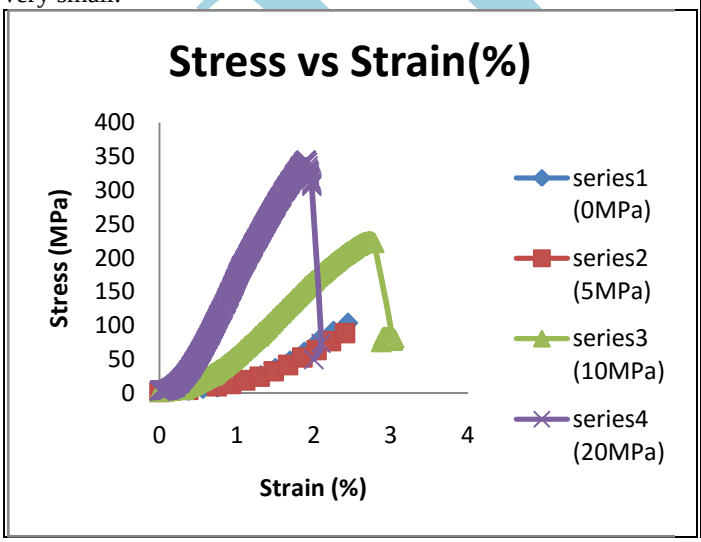

Fig.3 Stress vs Strain (%) of HP rock specimens

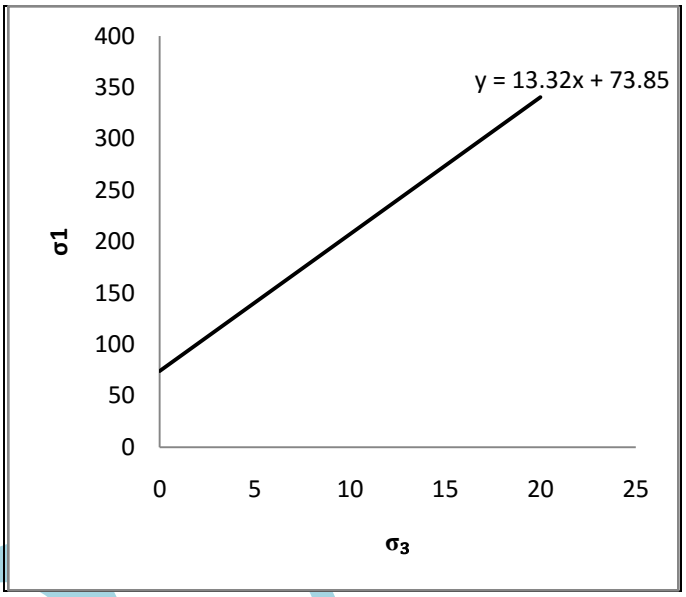

Fig.4 σ1 vs σ_3 HP rock specimens

By the testing results, values of shear strength parameters of HP specimens are:-

σcm = 73.85; c = 10.12; k = 13.32; ϕ = 59.35

Similarly the combined stress-strain behavior of the specimens of Jammu rock sample as shown in fig.5 clearly reports that as the confining pressure is high the stress is also high and if it is minimum then stress is minimum which explains that confining pressure plays vital role in stress-strain behavior of the specimens due to which the shear strength parameters vary.

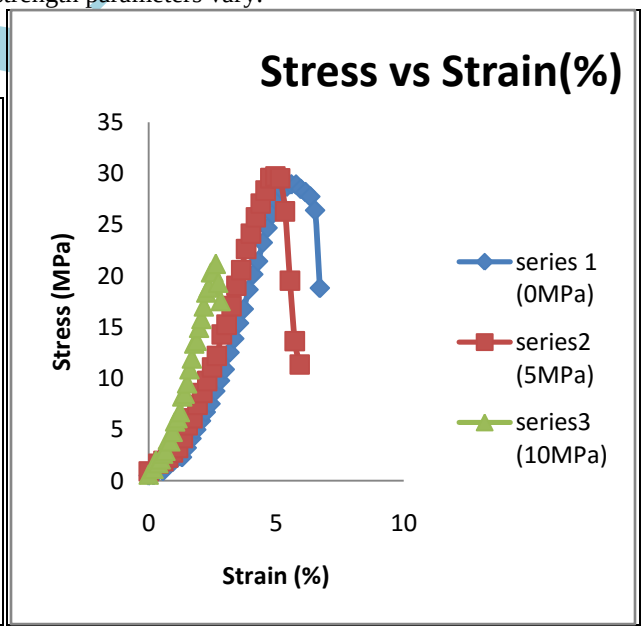

Fig.5 Stress vs Strain (%) of Jammu specimens

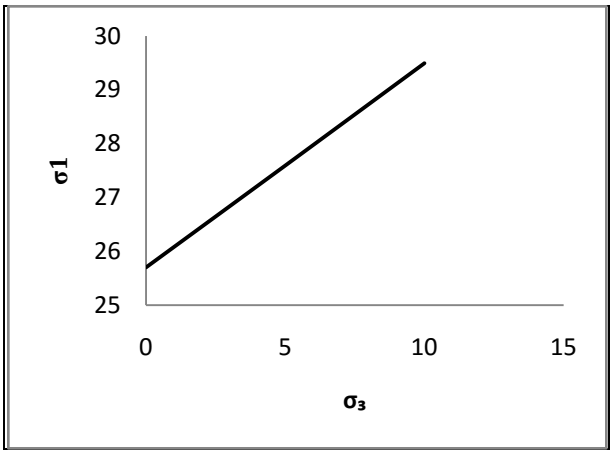

Fig.6 σ1 vs σ₃ Jammu specimens

The shear strength parameters of Jammu specimens are:-
σcm = 25.7;k = 0.379;c = 20.873;ϕ = 26.764
The mode of failure after attains the maximum strength is shear failure of both the rock specimens as shown in fig.7 and fig.8 after triaxial testing.

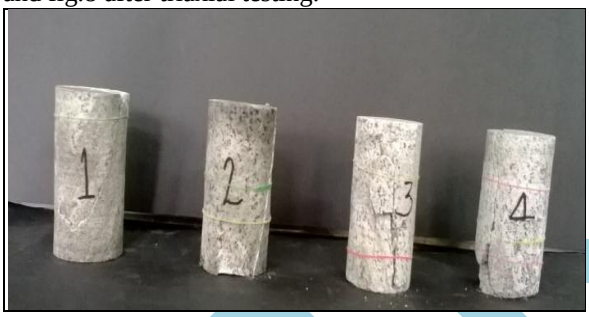

Fig.7 Failure mode of specimens (HP)

Fig.8 Failure mode of specimens (Jammu)

The mode of failure is shear failure in both types of specimens from two different states as shown in fig.9 and fig.10 after performing the point load testing these figures clearly shows that the failure conditions of regular and irregular specimens of Himachal Pradesh rock sample and similarly the modes of failure is attain from Jammu rock sample.

Fig.9 Failure mode of regular specimens (HP)

Fig.8 Failure mode of irregular specimens (HP**)**

CONCLUSION

The present study reports the comparison of the Himachal Pradesh and Jammu rock samples on the basis of the experimental study in the laboratory of IIT Roorkee. The paper conclude that after the comparison of both the testing results of point load test and the triaxial test that the rock sample of Una district of Himachal Pradesh is stronger than the rock sample of Jammu district of Jammu and Kashmir.

IV. SCOPE FOR FURTHER STUDY

The rocks are test in further studied by taking into account the following parameters:

i) Take material from other place,
ii) Shear test also performed
iii) Test with admixtures

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