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# Experimental Study on Strength and workability of concrete Using Rice Husk Ash and Quarry Dust Concrete

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**Abstract: The versatility, durability, sustainability, and economy of concrete have made it the world's most widely used construction material. Concrete is a family of different material like binding material (cement, flyash), fine aggregate, coarse aggregate and water. Often, additives and reinforcements are included in the mixture to achieve the desired physical properties of the finished material. When these ingredients are mixed together, they form a fluid mass that is easily molded into shape. Over time, the cement forms a hard matrix which binds the rest of the ingredients together into a durable stone-like material with many uses. The aim is to mix these materials in measured amounts to make concrete that is easy to: Transport, place, compact, finish and which will set, and harden, to give a strong and durable product. The amount of each material (ie cement, water and aggregates) affects the properties of hardened concrete.**
**In the present experimental work, an approach is made by replacing cement with Rice Husk Ash and Fine aggregates with Quarry dust. The percentage level of cement replacement will be 0%,15%,&30% and fine aggregates replacement is 0%,15%,30%,45% &60%. The workability and strength properties of QD and RHA concrete is investigated. The results concluded that there is decrease in workability with increasing percentage of QD and RHA and increase in strength with increasing percentage of QD and RHA up to certain limit.**

***Keywords:*** **Ground Granulated Riec Husk Ash, Quary Dust, Strength properties of concrete**

## I. GENERAL

The growth in infrastructure sector led to scarcity of cement because of which the cost of cement increased incrementally. In India, the cost of cement is increasing day by day. In order to combat the scarcity of cement and the increase in cost of concrete under these circumstances the use of recycled Cement Kiln Dust, solid wastes, agricultural wastes, and industrial by-products like fly ash, blast furnace slag, silica fume, rise husk, phosphogypsum, etc. came into use.

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The proportions of each material in the mixture affects the properties of the final concrete. These proportions are best measured by weight. Measurement by volume is not as accurate, but is suitable for minor projects. The proportions ofvarious ingredients are determined by proper mix design [1-15].

**RICE HUSK ASH**

Rice husk is an agricultural residue which accounts for 20% of the 649.7 million tons of rice produced annually worldwide.The produced partially burnt husk from the milling plants when used as a fuel also contributes to pollution and efforts are being made to overcome this environmental issue by utilizing this material as a supplementary cementing material [16].

RHA generally referred to an agricultural by-product of burning husk under controlled temperature of below 800 °C. The process produces about 25% ash containing 85% to 90% amorphous silica plus about 5% alumina, which makes it highly pozzolanic.RHA possibly compensate the problem of recycling huge quantity of husk wastes to be landfilled due to lacking of knowledge about its commercial benefits. Rice husk ash (RHA) possesses high pozzolanic activities and very suitable as partial replacement of cement in concrete. Rice husk is produced in millions of tons per year as a byproduct material from agricultural and industrial processes. After full

combustion of rice husk, it produced 20–25% RHA by weight. RHA contains non-crystalline silica and it could be a suitable partly replacement for Portland cement [17].

**QUARRY DUST**

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste. So it becomes as a useless material and also results in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the cost of construction and the construction material would be saved and the natural resources can be used properly [18].

## II. LITERATURE REVIEW

**S.N.Raman et.al (2011)** This paper presents the findings from experimental work undertaken to evaluate the suitability of quarry dust as a partial substitute for sand in high-strength concrete containing rice husk ash. Two grades of High Strength Concrete mixes, to achieve were designed with and without the incorporation of RHA. Quarry dust was then used in the mixes containing RHA as a partial substitute for sand, in quantities ranging from 10% to 40%. The results showed the mixes containing 20% quarry dust were chosen as the optimum mix design for both grades of concrete. The results also suggests that incorporating RHA improves the properties of concrete and compensates the negative effects of concrete containing Quarry dust only.

**Maurice E. Ephraim et.al (2012).** This research work was experimentally carried out to investigate the effects of partially replacing Ordinary Portland cement with our local additive Rice Husk Ash which is known to be super pozzolanic in concrete. The percentage replacement level was upto 25%. The results concluded that strength properties improves by using RHA in concrete.

**Godwin A. Akeke et.al (2013)**This research was experimentally carried out to investigate the effects of introducing Rice Husk Ash as a Partial Replacement of Ordinary Portland Cement on the Structural Properties of Concrete. A study was carried out on its flexural properties to determine their moduli of rupture as well as its tensile strength characteristics for the determination of cracking. The compressive strength and workability tests suggests that RHA could be substituted for OPC at up to 25% in the production of concrete with no loss in workability or strength. Based on the results of split Tensile Strength test, it is convenient to state that there is no Substantial increase in Tensile Strength due to the addition of RHA. The Flexural strength studies indicate that there is a marginal improvement with 10 to 25% RHA replacement levels.

**Anzar Hamid Mir (2015)** In this paper Attempts have been made to study the suitability of Quarry dust as sand replacing material and it has been found that Quarry dust improves the mechanical properties of concrete as well as elastic modulus. The optimum compressive strength is achieved at the proportion of fine to coarse with 60:40 ratio. The study suggests that stone dust is quite appropriate to be selected as the substitution of fine aggregate.

**K. Shyam Prakash et.al (2016**) in this experimental work it is concluded that the quarry dust can be used as a replacement for fine aggregate.finraggragtes were replaced upto 100% and various tests conduscted on different concrete mixes. It is found that 40% replacement of fine aggregate by quarry dust gives maximum result in strength than normal concrete and then decreases from 50%. The compressive strength is quantified for varying percentage and grades of concrete by replacement of sand with quarry dust.

**Kankipati Dinesh kumar et.al (2018)** This investigation studies the partial replacement of cement by quarry dust of percentages 0%, 5%, 15%, 25%, 35% for M25 grade concrete. The rice husk ash is added in certain proportions such as 0%, 5%, 10%, 15% and 20% and strength tests were conducted on different mixes. Results concluded that replacement of quarry dust has its optimum strength at 25% for this rice husk ash is added. Results obtained from this gives better workability and increased in its hardened concrete properties compare to normal concrete.

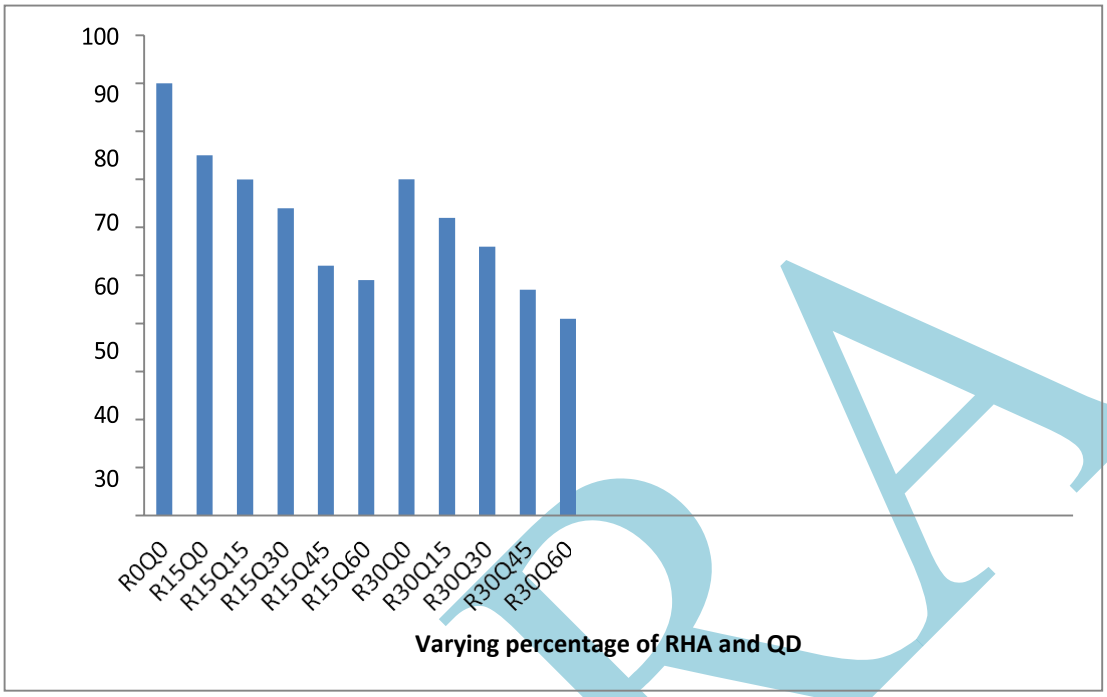
**Mohammed Imran(2018)** The present work is an attempt to understand the effect on concrete strength and durability characteristics of concrete by partial replacement of sand with quarry dust. This experimental study presents the variation in the strength and durability properties of concrete when replacing sand by quarry dust from 0% to 50% in interval of 10% .Various strength and durability tests conducted in the laboratory are compressive strength test, Flexural Strength test, Split tensile strength test, Acid resistant test, sulphate resistant test, Chloride resistant test and Water absorption test. Effect on mechanical properties with replacement of 20% sand with quarry dust resulted that there is increase in Compressive strength by around 10%, Split tensile strength by 15% and Flexure Strength by 10%.

## III. RESULTS AND DISCUSSIONS

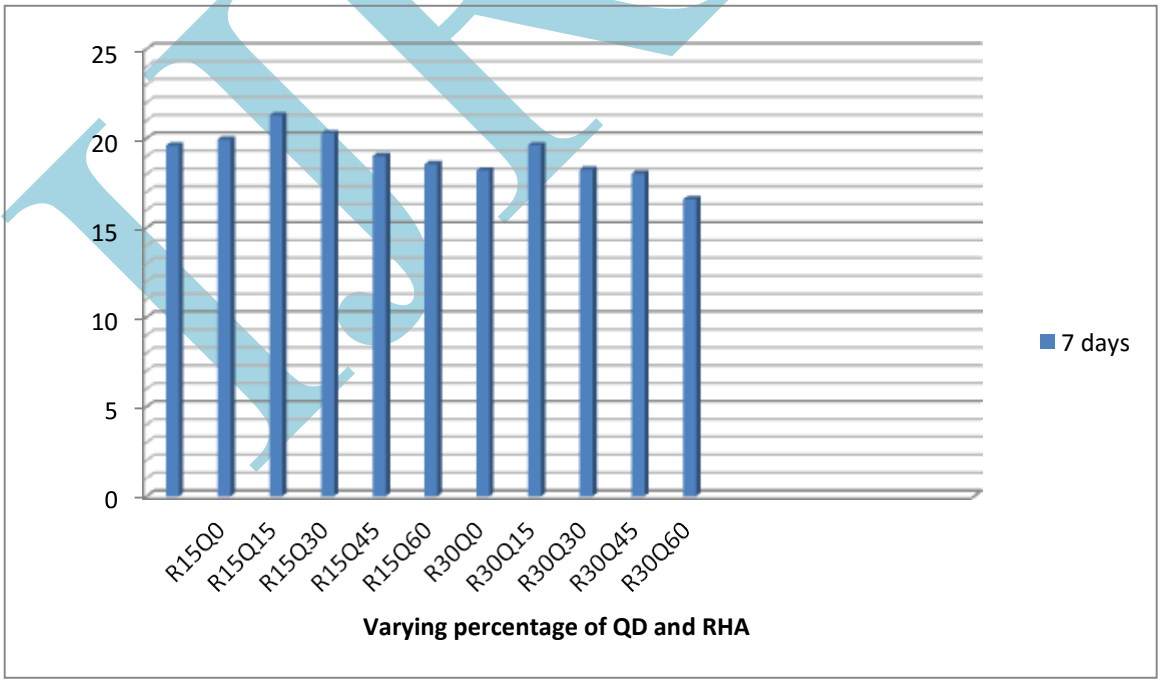
**Slump Cone Test**

The workability of concrete depends on the water cement ratio and the water absorption capacity of the aggregates. If the water added is more which will lead to bleeding or segregation of aggregates. The test for the workability of concrete is given by the Indian Standard IS 1199-1959 which gives the test procedure using various equipments. In our case we have used slump cone test for measuring the workability of concrete [19].




**Slump value with varying percentage of QD and RHA in Concrete**



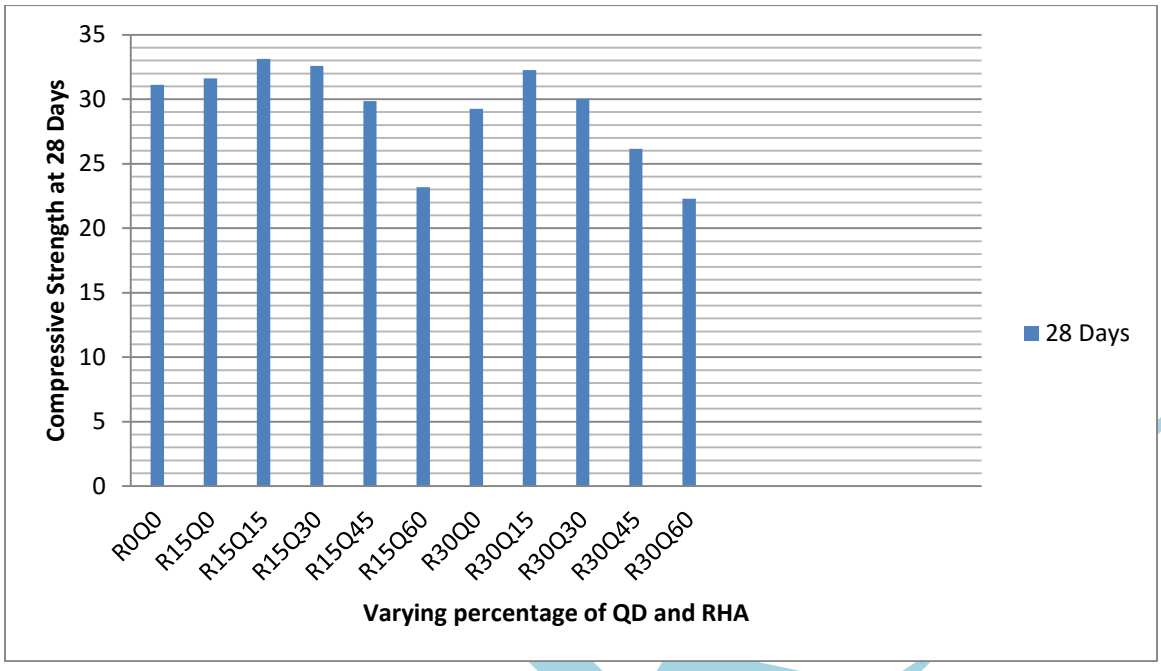
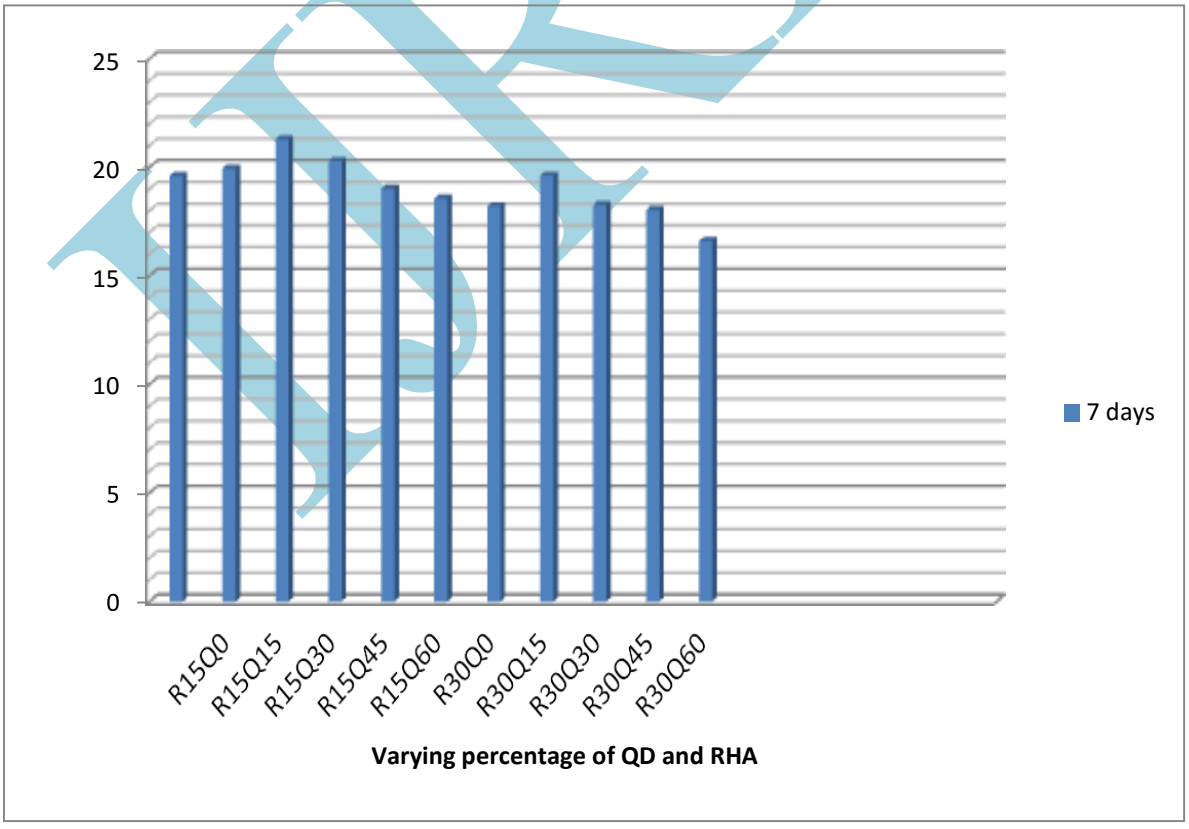



**Figure:Chart representing Compressive strength at 28 days with varying percentage of QD and RHA in Concrete**



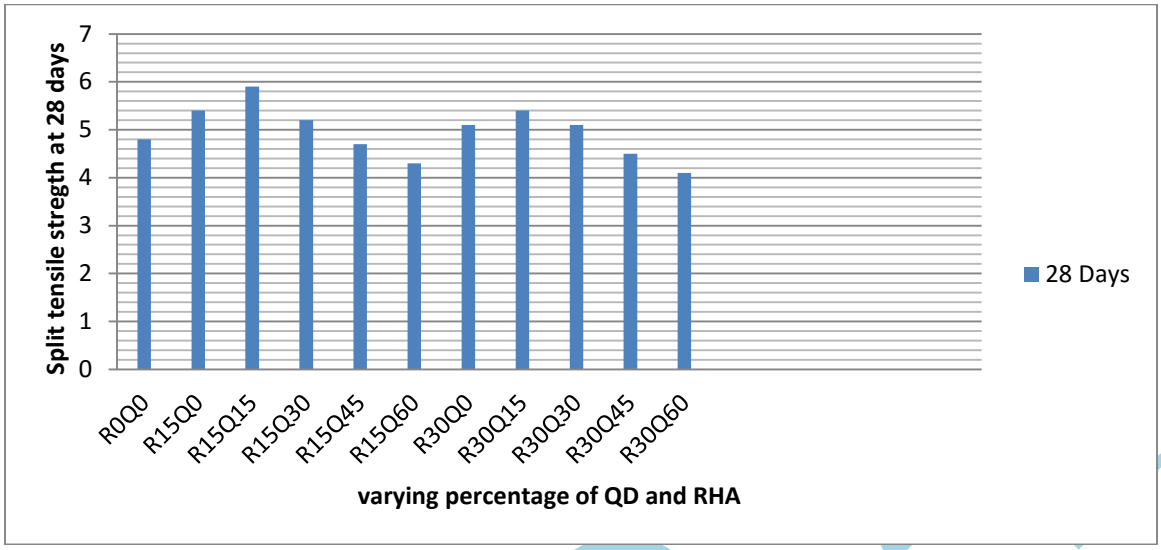
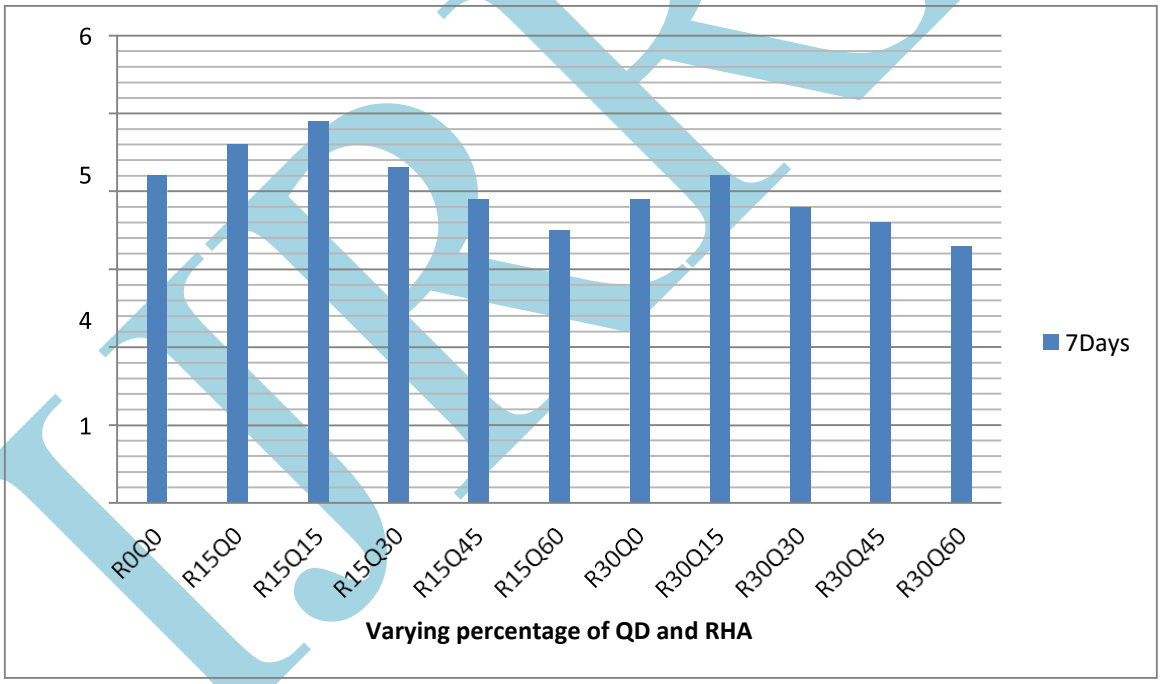



**FIGURE: Chart representing Variation of Split Tensile Strength at 7& 28 days for Different Concrete Mixes**



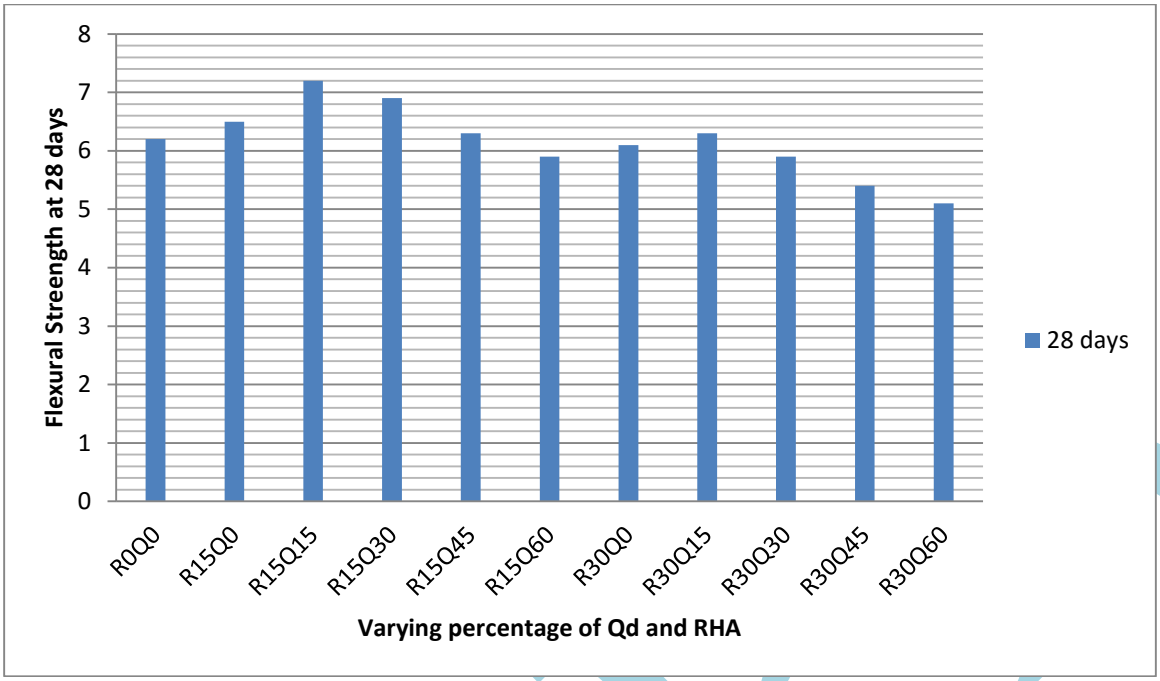



**Chart representing Variation of Flexural Strength at 7 & 28 days for Different Concrete Mixes**

## IV. CONCLUSIONS

The results of workability by Slump test method concluded that workability decreases with increasing percentage of Rice Husk Ash and Quarry Dsut. This may be due to water demand increases with increasing percentage of RHA [20].

Workability results also concludes that with increasing percentage of Quarry Dust workability decreases and it may be due to higher water absorption of quarry dust due to presence of high amount of silt content in Quarry Dust as compared to sand.

The above results shows that with increasing percentage of Rice Husk Ash the Compressive strength fo RHA and QD Concrete increases. Further replacing fine Aggregates with Quarry dust has shown positive impact on compressive strength upto 30% replacement.

The optimum replacement percentage of RHA and QD in terms of strength and economy is R15Q30. The value of compressive strength obtained at optimum percentage replacement is 32.59 which is 4.7% more than normal Mix.

The split tensile strength and flexural strength shown similar behaviour as that of compressive strength.

The optimum replacement percentage of RHA and QD in terms of strength and economy is R15Q30.

The use of RHA and QD in civil engineering works will reduce environmental pollution, improve quality of concrete, and reduce its cost of production

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