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An Experimental Study on the Behaviour of Concrete by Partial Replacement of Coarse Aggregate by Bamboo and Cement with Quarry Dust

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ABSTRACT: The concept of replacement of natural coarse aggregate by bamboo and cement by quarry dust which is highlighted in the study could boast the consumption of quarry dust which a waste material generated from quarries. Cement plays an important role in binding fine aggregate and coarse aggregate in concrete mixture. The demand of cement in construction of buildings or concrete infrastructures globally and huge population construct buildings day by day results in shortage of cement supply and available at very high cost. Similarly, coarse aggregate is expensive due to excessive cost of transportation from natural resources or providing it through black marketing has higher and higher the rate of coarse aggregate. The stated situations are responsible to make cement and coarse aggregate as scarce material. To solve the problem, bamboo and quarry dust substitute materials for both coarse aggregate and cement. In this study, the investigation carried out on strength characteristics of bamboo and quarry dust on M25 concrete grade. The percentage of bamboo added by volume basis was 0,3%,6%,9%,12%,15%,18%,21% as replacement of coarse aggregate and 0,4%,8%,12%,16%,20%,24% and 28% as replacement of cement with quarry dust. This review study is a trial of giving some highlights on using bamboo and quarry dust as partial replacement material to coarse aggregate and cement and is reducing the environment wastes which pose a difficult problem in its disposal.

KEYWORDS: Bamboo, Quarry dust, Coarse aggregate, Cement, Compressive strength, Flexural strength

I. INTRODUCTION

GENERAL

Concrete is one of the most commonly used Construction materials worldwide. The need for infrastructural development in both the developing and the developed countries had placed a great demand of the Concrete, which is used for construction of variety of infrastructure applications including tiny and huge buildings, houses, bridges, storage tanks, dams and numerous other types of structures.

Concrete may be defined as the composite material composed of the binding medium such as the mixture of cement, water, and different fine and coarse aggregates. Many people are considering cement as concrete, but cement is only a important part of concrete. Concrete structures that have been built all over the world are subject to a wide range of different circumstances of use and associate to environmental conditions comprising erosion, weather, and pollution

There are different types of waste materials being used in the industry to produce cement. Cement is essential and naturally production and quarry dust also associates with it. Quarry dust gives harmful disease like lungs cancer, Asthma, eye disease etc. Using of waste to make concrete is a good and new technique to handle waste material from various industries. Quarry dust is a waste from the crushing materials which accounts 24%-30% of the final product from stone crushing unit and a reason to cause environmental pollution.

Quarry dust is throwing as useless material causing air pollution. Recycling such type of wastes by incorporating them into building materials is a temporary solution for pollution problem and can become an alternative building material or admixture as partial replacement for cement to make the concrete more economical and also to have higher workability along with long term strength. To study the durability and strength of concrete tests were conducted on cubes made of



quarry dust and the results were compared with the natural sand concrete. The compressive strength, flexural strength and durability test of concrete made of quarry dust shown results that are approximately 10% more than the concrete. In large scale, Quarry dust is used in the highways in the form of surface finishing material and also, in producing of hollow blocks and lightweight concrete elements.

II. LITERATURE REVIEW

Mani Maran P.T. Ravichandran (2017) The percentage of bamboo and quarry dust added by volume was 0%, 5%, 10%, 15%, 20%, and 25% as replacement of coarse aggregate and fine aggregate. From these experimental results, concluded that 15 % of bamboo replacement in concrete gives good results on compressive strength, flexural strength, split tensile strength and durability test compare to concrete.

Venkata Sairam kumar N(2013): The aim of the experiment is to find the maximum content of quarry dust partial replacement of cement in concrete. The percentages of quarry dust partial replacement of cement in concrete are 0, 10%, 15%, 20%, 25%, 30%, 35%, and 40%. M20, M30, M40 grade concrete cubes of 150x150x150mm size were cast for conducting compressive strength test. From the experimental studies 25% of partial replacement of cement with quarry dust improved hardened concrete

Muhammad Umer Farooq (2015): Cement is being replaced with different types of waste materials to achieve the aforementioned benefits. This research paper reveals the effect of the partial replacement of cement with the Stone Quarry Dust on Compressive Strength and Splitting Tensile Strength of concrete. Cement was replaced in the following percentages to test the samples; 0%, 15%, 25% and 35%. It was found after testing that strength was increased 2 times for Q25 sample.

V. Aishwaryalakshmi (2017): The main aim focus of this paper was to quarry dust partial replaces natural sand in concrete for studying the hardened strength properties of concrete. Natural sand was replaced with Quarry dust by three proportions (i.e., 10%, 20%, and 30%). The study was carried out on M20 grade concrete with 0.5 water cement ratio.

B. Manoj1, G. Laxmi Prasanna, D. Sai Krishna, B. Siva Sankar Reddy, T. Vamsi Krishna, M. Surendra Reddy: The analysis of experimental investigation data shown that addition of 25% quarry dust with cement gives the compressive strength of 41.5 N/mm² when compared to conventional i.e., without any replacement of quarry dust

Ilangovana et al. gives attention to physical and chemical properties of quarry dust with respect to requirements of codal provision which are satisfied. The 100% replacement of sand with quarry dust gives better results in terms of compressive strength studies.

Sivakumar et al. (2010): The 28 days compressive strength of 100% replacement of sand with quarry dust of mortar cube (CM 1:1) is higher than the controlled cement mortar cube. The 56 days maximum Compressive strength, split tensile strength and modulus of elasticity of concrete for 100% replacement of sand with quarry dust of 400 kg/m³ at F/C=0.6, was higher than the reference concrete.

III. METHODOLOGY

CONCRETE MIXING- In the present work **M25** concrete grade was designed and the governing ratio of mix design was computed as 1:1:2. Concrete mixes were prepared by various replacement percentages of Quarry Dust (0%,4%,.8%,12%,16%,20%,24%,28%) and Coarse Aggregates with Bamboo Aggregates (0%,3%,6%,9%,12%,15%,18%,21%)

CASTING OF SPECIMENS-Specimens of different concrete mixes was casted using the mould. Three specimens will casted for each combination for testing purpose.

- Compressive strength test will be conducted on 150×150×150 mm size cubes.

COMPRESSIVE STRENGTH TEST

Out of many tests perform to the concrete; this is the utmost important which gives an idea about all the qualities of concrete. For cube test two types of specimens either cubes of 150 m X 150 m X 150 m or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical mould of size 150 m x 150 m x 150 m are commonly used.



concrete is poured in the mould and tempered properly so as not any voids left. After 24 hours these mould are removed and test specimens are put in water for curing. The upper surface of these specimens should be made even, smooth.

These samples or specimens are tested by testing machine known as compression testing machine after 3 days, 7 days curing or 28 days curing. Load should be applied gradually at the rate of 140 kg/cm² per minute till the concrete blocks or specimens fails. Load at the failure divided by area of specimen gives us the compressive strength of concrete.

$$\text{Compression Strength} = \text{Force} / \text{Area}$$

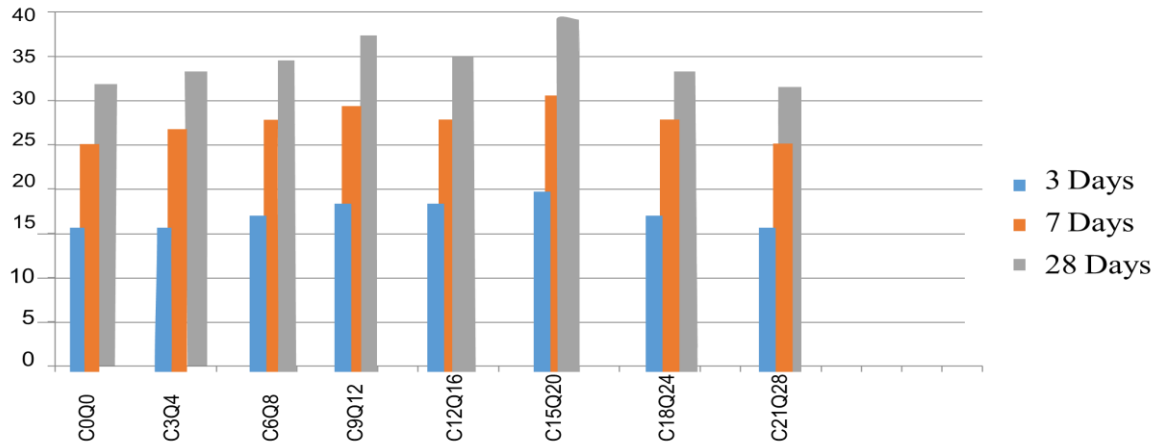


Compressive Strength test

Average Compressive Strength for 3, 7 and 28 days for coarse aggregate with bamboo and cement with Quarry dust

4	C9Q12	18.6	18.7	29.5	29.6	36.6	36.9
		18.9		29.6		36.8	
		18.6		29.7		37.3	
5	C12Q16	17.9	18.00	28.5	28.3	35.9	35.7
		18.5		28.6		35.6	
		17.6		27.8		35.6	
6	C15Q20	19.2	19.5	30.5	30.4	37.9	37.5
		19.8		30.4		37.5	
		19.5		30.3		37.1	
7	C18Q24	16.3	16.5	28.00	27.8	33.9	33.5
		16.8		27.9		33.3	
		16.4		27.5		33.3	
8	C21Q28	15.4	15.0	26.9	26.4	32.8	32.6
		15.00		26.2		32.1	
		14.6		26.1		32.9	

Average Compressive Strength for 3, 7 and 28 days for concrete by replacing cement with quarry dust and bamboo with coarse aggregate.



IV. CONCLUSION

Compression testing of the cube specimens was carried out in a compression testing machine. A set of 3 cubes were tested for each of the mix for their compressive strengths at 7, 14 and 28 days of curing. It is observed that, the compressive strength first increases up to 15% bamboo and 20% quarry dust replacement, afterwards that there is a downfall of compressive strength. The maximum compressive strength is achieved at 15% and 20 % replacement of coarse aggregates by bamboo and cement with quarry dust .The maximum value is obtained 37.5 at C15Q20 replacement.

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