Effect of Marble Dust and Banana Fibre on Strength Characteristics of Pavement Quality Concrete

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Abstract **- This study shows developing pavement quality concrete mixtures incorporating marble dust as partial replacement of cement as well as banana fiber. There is a growing interest in the construction of concrete pavements due to its high strength, durability, and better serviceability and overall economy in long run. This study also shows that in view of the high flexural strength, high values of compressive strength and high values of split tensile strength, higher load carrying capacity and higher life expectancy, the combination of 10 to 15% marble dust replacement along with addition of 0.5 banana fiber is ideal for design of Pavement Quality Concrete (PQC).By replacing cement with marble dust and adding fibers it has been possible to achieve savings in cement. To produce thinner and green pavement sections of better quality, which can carry the heavy loads, is nowadays thrust.**

Index Terms **- Pavement quality concrete (PQC), High strength concrete, Aggregates, Banana Fibre, Marble Dust.**

INTRODUCTION

GENERAL

As we know concrete is a versatile construction material. Firstly it was innovated as protective cover of steel members, after that it was received and nowadays concrete is used as a structural member and for modifying its properties and give better strength to the concrete steel is provided. The word concrete comes from the Latin word "concretus" (meaning compact or condensed).During Roman Empire, roman concrete was made from quicklime, pozzolana and an aggregate of pumice. Concrete is a composite construction material composed primarily of aggregate, cement and water. The aggregate is generally coarse gravel or crushed rocks as limestone, or granite, along with a fine aggregate such as sand. The cement, commonly Portland cement and other cementations materials such as fly ash and slag cement serve as a binder for the aggregate. To achieve varied properties various chemical admixtures are also added. Concrete is reinforced with materials that are strong in tension because concrete has relatively high compressive strength. Concrete can be damaged by many processes such as freezing of tapped water. Concrete can make energy efficient housing as it has high thermal mass and very low permeability. Structures made of concrete can have long service life. It is very important to design a higher proportion of the available strength of concrete with efficiency and effectively rather than a smaller proportion of much strength concrete as per economic point of view. The benefits of concrete like resistance, resistance to water, ability to mould into various sizes and shapes as per requirement, economic and easily available material on site. Normal concrete has much inadequacy such as low value of strength to weight ratio as compared to steel. So, as to overcome this inadequacy resulted in high strength concrete (HSC).In my thesis I have partially replaced cement with the marble dust with addition of banana fibre.

LITERATURE REVIEW

Marble Dust:

Manju Pawaret.al (2014) a study was conducted on periodic research, the effect of replacement of cement with marble dust. In this study they found that the effect of using marble dust as constituents of fines in concrete by reducing the quantity of cement has been studied in terms of relative compressive strength, tensile strength and flexural strength. They replaced cement by varying percentage of marble powder which results in increased strength. The compressive strength of concrete is increased with addition of marble dust up to 12.5% replace by weight of cement as per the study.

B.V.M.Sounthararajan et.al (2013) they concluded that the marble dust powder up to 10% by weight of

cement was investigated foe hardened properties of concrete. Different percentage of cement replaced with marble dust to determine the compressive strength, tensile strength and flexural strength was evaluated. They found that the fine to coarse aggregate ratio and cement to total aggregate ratio had higher influence on improvement in strength properties.

Corinaldesi V et.al (2010) in palaces and monuments marble was used as a building material since ages. However, the use is limited as stone bricks in wall or lining slabs in walls, roofs or floors leaving its wastage. They concluded that the mass which is 40% of total marble quarried has reached as high as millions of tons.

BANANA FIBRE:

N.Venkateshwaean et.al (7) this paper presents a summary of research work published in the field of banana fibre with special references to physical properties, mechanical properties. They studied that due to low density, high tensile strength, high tensile modulus fibres are very have good potential use in various sectors like construction, machinery etc.

Satish Pujari et.al (8) they concluded that the use of cheaper goods is very useful in fields like engineering, high performance applications such as shipping, sporting goods, aerospace, leisure etc. The present review explores the potential of jute and banana fibre on both physical, mechanical properties and chemical composition.

SELECTION OF MATERIALS AND METHODOLOGY

Cement:-

From strength and workability point of view the development of high strength concrete (HSC) will require the utilization of Portland cement of optimum quality. In my thesis work I have used OPC (Ordinary Portland Cement) 43 grade cement.

Aggregates:-

Aggregates is a vast variety of coarse to fine grained particles used in concrete like gravel, sand, crushed stone. Aggregates are broadly classified into two types depending on size of particles discussed below:-

- Coarse Aggregates
- Fine Aggregates

Coarse Aggregates:

Sand, natural gravel and crushed stone are used for this purpose. Coarse aggregates make up bulk of a concrete mixture. The ideal aggregates should be angular, clean, cubical, 100% crushed and continuously graded.

Fine Aggregates:

The properties of concrete in fresh as well as in hardened state are affected by the characteristic property and quality of fine aggregates. Sand is most commonly used fine aggregate in concrete.

Water:

Water acts as important constituent in concrete. I used tap water with properties same as that of normal water of specific gravity 1.0.

Marble Dust :

Since ancient times marble dust has been commonly used as building material. As a by-product marble dust is a very important material. Marble dust is a waste product formed during the production of marble, a large quantity of powder is generated during cutting process.

Banana Fibres:

Banana fibre mainly consists of cellulose, hemicellulose, and lignin. It is highly strong fiber. Depending upon the extraction and spinning process banana fibre has shiny appearance.

TEST METHODS

1. Sieve Analysis of Coarse and Fine Aggregate
2. Compressive Strength of Concrete
3. Split-Tensile Strength of Concrete
4. Flexural Strength of Concrete

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CONCLUSION

- This whole experimentation was carried about to know the combined effect of Marble Dust and Banana Fibre on M-30 Grade concrete.
- This whole experimentation was done by testing the samples for Workability, Compressive Strength, Split-Tensile Strength and Flexural Strength.
- After completion of this process the results obtained from these experiments were compared with PCC-M-30 Grade of concrete.
- Given below points were concluded from the whole experiment:

1. Decrease in workability of concrete was found when there is increase in percentage of Marble Dust up to 15% and keeping Banana Fibre at constant rate of 0.5%.
2. Increase in Compressive Strength of concrete sample when cement was replaced by 10% of Marble Dust by weight. Moreover, at replacement of 15% of cement by Marble Dust decrease in compressive strength was marked.
3. After 7 days Split-Tensile strength decreased but after 14 days and 28 days the Split-Tensile Strength increases by replacement of cement by 10% Marble Dust.
4. Flexural Strength of concrete samples decreases after 7 days but increases after 14 days and 28 days.
5. At the end it was concluded that maximum strength was gains at replacement of cement by 10% of Marble Dust and keeping Banana Fibre constant at0.5 %.

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