STUDY ON STRENGTH & DURABILITY OF CONCRETE BY PARTIAL REPLACEMENT OF FINE & COARSE AGGREGATES USING MARBLE, GRANITE & SPENT FIRE BRICK WASTE

PARTIAL REPLACEMENT OF FINE & COARSE AGGREGATES

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***Abstract*: Concrete is the most undisputable and indispensable material being used in infrastructure development throughout the world. Umpteen varieties of concretes (FAC, HVFAC, FRC, HPC, HSC, and others) were researched in several laboratories and brought to the field to suit the specific needs. Marble, granite and Spent Fire Brick industry has grown significantly in the last decades with the privatization trend in the early 1990s, and the flourishing construction industry. Accordingly, the amount of mining and processing waste has increased. Stone waste is generally a highly polluting waste due to both its highly alkaline nature, and its manufacturing and processing techniques, which impose a health threat to the surroundings. The objective of this paper is to utilize marble, granite and Spent Fire Brick waste of different sizes in the manufacturing of concrete bricks, with partial replacement of conventional coarse and fine aggregates with Marble, Granite and Spent Fire Brick waste content up to 20%.The produced bricks are tested for physical and mechanical properties according to the requirements of the American Standards for Testing Materials (ASTM) and the IDIAN Code. The test results revealed that the recycled products have physical and mechanical properties that qualify them for use in the building sector.**

Index Terms*: *granite, marble

I. INTRODUCTION

There is an era of industrial explosion. So, it may lead to increasing demand of natural resources. The cost of natural resources is also increased. They have forced to focus on recovery, reuse of natural resources and find other alternatives. Stone waste/Granite has been commonly used as a buildingmaterial.Todayindustry‟‟sdisposalofthestonewaste/Granitepowdermaterialisoneof the environmental problems around the world. Stone waste/Granite blocks are cut into smaller blocks in order to give them the desired shape and size. During the process of cutting, in that original stone waste/Granite mass is lost by 30% in the form of dust. Every year 250-400 tons of stone waste/Granite waste is generated at site. The stone waste/Granite cutting plants are dumping the powder in any nearby pit or vacant spaces, near their unit although notified areas have been marked for dumping. This leads to serious environmental and dust pollution and occupation of vast area of land especially after the powder dries up.so it is necessary to dispose the stone waste/Granite waste quickly & use in construction industry.

OBJECTIVES, SCOPE AND METHODOLOGY OF THE STUDY

Objective of the study

II. The advancement of concrete technology can reduce the consumption of natural resources and energy sources and lessen the burden of pollutants on environment. concrete bricks can be the best application to utilize marble, granite and spent firebrick waste in large quantities to replace the conventional sand and aggregates.

Normally, aggregates in concrete bricks are dolomite as the coarse aggregate, and sand as the fine component. these can be replaced by marble, granite and spent firebrick waste. actual figures about the quantity of waste produced in india from the marble, granite and spent firebrick industry are inaccessible since it is not calculated or monitored by the government or any other party.

However, the waste produced during the processing stage only ranges from 20-50% as indicated based on the lowest estimates of waste percentage. so, by using this waste in replacement of aggregates will lower the waste.

This project describes the feasibility of using the marble, granite and firebrick waste in concrete production as partial replacement of aggregates.

Scope of the study

III. This study is concentrated on the performance of a multiple gradation of marble, granite and spent firebrick waste. the waste materials are collected from local sources and manually broke into pieces to achieve a uniform size of 10 mm and 20 mm, which is the aggregate size of the mix design.

IV. the influence of different gradations of the marble, granite and spent firebrick aggregate on concrete properties was not evaluated in this study but it should be considered in future researches.

V. the influence of using recycled marble, granite and spent firebrick in high strength concrete wasnotcoveredinthepresentstudy.thepercentagereplacementswerelimitedtofourcategories i.e. 0%, 5%, 10% and 20%replacement of natural aggregates. the different effects, which can be observed in different percentages of replacements, were not included in the present study.

4. MATERIAL PROPERTIES

VII.CHARACTERISTICS OFCONCRETE

Concrete is a composite material composed of coarse granular material (the aggregate or filler) embedded in a hard matrix of material (the cement or binder) that fills the space between the aggregate particles and glues them together. In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of Portland cement and water, coats the surface of the fine and coarse aggregates.

Concrete is the world's most important construction material. The quality and performance of concrete plays a key role for most of the infrastructures including commercial, industrial, residential and military structures, dams, power plants and transportation systems The worldwide use of concrete materials accounts for nearly 780 billion dollars in annual spending. The ability of concrete to be cast to any desired shape and configuration is an important characteristic that can offset other shortcomings. Good quality concrete is a very durable material and should remain maintenance free for many years when it has been properly designed for the service conditions and properly placed. Of course, proper use of the structure for the intended function can have a significant role. Through choice of aggregate or control of paste chemistry and microstructure, concrete can be made inherently resistant to physical attack, such as from cycles of freezing and thawing or from abrasion and from chemical attack such as from dissolved sulfates or acids attacking the paste matrix or from highly alkaline pore solutions attacking the aggregates.

Judicious use of mineral admixtures greatly enhances the durability of concrete. The main advantages of concrete as a construction material are the ability to be cast, being economical, durability, fire resistance, energy efficiency, on-site fabrication and its aesthetic properties. Whereas the disadvantages are low tensile strength, low ductility, volume instability and low strength to weight ratio.

SPENT FIRE BRICK (20MM)				
GRADE OF CONCRETE	M 25			
% OF SPENT FIRE BRICK	0%	5%	10%	20%
7 DAYS KN/M2	88.8	133.3	111.1	166.6
14 DAYS KN/M2	133.3	177.7	155.5	200
28 DAYS KN/M2	191.1	253.3	222.2	300
60 DAYS KN/M2	210.2	278.6	244.4	329.7
90 DAYS KN/M2	206.6	273.7	240.4	324.4

VIII.PROPERTIES OF MARBLE, GRANITE AND SPENT FIRE BRICK AGGREGATE:

If coarse grained marble is heated to around 6OO°C the anisotropy of thermal expansion of calcite causes almost complete separation at grain boundaries. The resulting material retains its shape and consists of a mass of crystals in contact, with a porosity of about 4%, very small direct tensile strength and the mechanical analysis and permeability to water of sand. It may be regarded as a laboratory model of randomly jointed rock and perhaps of bad and broken rock in general. It has frequently been suggested that soil mechanics theory may be applied to suchrock.

This Paper examines the mechanical properties of the heated marble and shows that they different from those of soils. A small amount of confining pressure varies the tri-axial strength rapidly, the initial slope of the Mohr envelope being of the order of 65° and the

strength finally increasing to over 80% of that of the original rock. Young's modulus also increases with confining pressure but only to about 30% of that of original rock.
Even if one principal stress is tensile, a perpendicular compressive stress greatly increases the strength. Model „plate bearing" tests give the same value of Young's modulus as compression ofcylinders, suggesting that this may be true for full scale tests on bad rock.

Permeability is found to decrease rapidly with confining pressure and slightly with un-axial stress. Pronounced effects of size on strength are observed which appear to deviate from the usual power or Proto-dyakonov laws at smallsizes.
Granite aggregates are crushed hard rock of granular structure, being the most common on Earth. Granite rock comes from magma that erupted on the ground surface and then hardened. Good properties of granite make it the most popular building material.

Fig 4.1 Compression Testing Machine

IX CONCLUSIONS

Based on limited experimental investigation concerning the compressive and split tensile strength of concrete, the following observations are made regarding the resistance of partially replaced fine and coarseaggregates.

1. Marble and granite waste cement bricks yield similar mechanical, in terms of compressive strength, and physical, in terms of density and absorption, properties. There is a positive effect of granite waste on cement brick samples that reach its optimum at 20% granite waste incorporation.

2. Absorption is the major drawback of waste incorporation in cement bricks according to the ASTM C55 where water absorption requirement is fulfilled only at Zero, 5%, 10 %, and 20% slurry samples for grades.

3. The SFB is a locally available, low cost, and inert industrial solid waste whose disposal is a matter of concern likes construction waste. On an overall, the CSFB can be comparable to the natural river sand. The CSFB satisfies the zone II gradation for not only to partially replace the sand, but for making good concrete, Unit weight of CSFB is higher than that of river sand aggregate in dense condition which, in turn, contributes to the increase in the unit weight of concrete containing CSFB as a fineaggregate.

4. From the obtained results we observe that the maximum strength is achieved by 25% of CSFB replacement in concrete. The 30th% of CSFB replacement in concrete indicates there is no strength gaining after increasing theproportion.

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