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Partial replacement of sand by granite powder in concrete

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ABSTRACT: The main objective of Waste Management System is to maximize economic benefits and at the same time to protect the environment. Granite process industry generates a large amount of wastes mainly in the form of powder during sawing and polishing processes, which pollute and damage the environment. This work aims to characterize and evaluate the possibilities of using the granite sawing wastes, generated by the process industries from Salem District, as alternative raw materials in the production of concrete. This granite powder waste can be utilized for the preparation of concrete as partial replacement of sand. In order to explore the possibility of utilizing the granite powder as partial replacement to sand, an experimental investigation has been carried out. The percentages of granite powder added to replace sand by weight were 0, 5, 10, 15, 20 and 25. This attempt has been done due to the exorbitant hike in the price of fine aggregate and its limited availability.
KEYWORDS - Granite powder- replacement of sand- environmental protection- economical.

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I. INTRODUCTION

Fine aggregate is an essential component of concrete. The most commonly used fine aggregate is natural river sand. The global consumption of natural river sand is very high due to the extensive use of concrete. In particular, the demand of natural river sand is quite high in developed countries owing to infrastructural growth. The non-availability of sufficient quantity of ordinary river sand for making cement concrete is affecting the growth of construction industry in many parts of the country. Recently, Tamil Nadu Government (India) has imposed restrictions on sand removal from the river beds due to its undesirable impact on the environment. On the other hand, the granite waste generated by the industry has accumulated over years. Only insignificant quantity has been utilized and the rest has been dumped unscrupulously resulting in pollution problems. With the enormous increase in the quantity of waste needing disposal, acute shortage of dumping sites, sharp increase in the transportation and dumping costs necessitate the need for effective utilization of this waste. The present work is aimed at developing a concrete using the granite scrap, an industrial waste as a replacement material for the fine aggregate. By doing so, the objective of reduction of cost of construction can be met and it will also help to overcome the problem associated with its disposal including the environmental problems of the region. Accordingly this project work will examine M40 grade of concrete cast by varying percentage of replacement of sand with granite powder.

1) Problem statement

In general we have been using natural sand as fine aggregate. Now a days infrastructure development has tremendous growth. Required sand has developed and it is becoming costly. Usage of Granite Powder as fine aggregate will fulfill the requirements of natural sand.

2) Quarry Dust

Quarry Dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate Also, the use of Quarry Dust as the fine aggregate decreases the cost of concrete production in terms of the complete replacement for natural river sand. This paper reports the experimental study which investigated the influence of 100% replacement of sand with quarry Dust.

Currently India has taken a major initiative on developing the infrastructures such as express highways, power projects and industrial structures etc., to meet the requirements of globalization, in the construction of buildings and other structures concrete plays the rightful role and a large quantum of concrete is being utilized. River sand, which is one of the constituents used in the production of conventional concrete, has become highly

expensive and also scarce. In the backdrop of such a bleak atmosphere, there is large demand for alternative materials from industrial waste.

The utilization of Quarry Rock Dust which can be called as manufactured sand has been accepted as a building material in the industrially advanced countries of the west for the past three decades [15]. As a result of sustained research and developmental works undertaken with respect to increasing application of this industrial waste, the level of utilization of Quarry Rock Dust in the industrialized nations like Australia, France, Germany and UK has been reached more than 60% of its total production. The use of manufactured sand in India has not been much, when compared to some advanced countries.

This paper presents the feasibility of the usage of Quarry Rock Dust as hundred percent substitute for Conventional Concrete. Tests were conducted on cubes and beams to study the compressive, flexural strengths of concrete made of Quarry Rock Dust for three different proportions and five different methods. Durability Studies were done for concrete with Quarry Rock Dust and compared with the Conventional Concrete

II. RESULT AND SOLUTION

TABLE.1. Physical Properties of Pond Ash

Properties	**Pond Ash**
Physical Properties	
Color	Whitish grey
Specific Gravity	2.153
W. Absorption in 24 hours	44.50%

TABLE.2. Sieve Analysis

IS sieve size	**Weight retained gm**	**Cumulative weight retained gm**	**Cumulative percentage weight retained**	**Cumulative percentage passing**
40	0	0	0	100
20	0	0	0	100
10	10	10	2	98
4.75	40	50	10	90
2.36	30	80	16	84
1.18	105	185	37	63
600mic	160	345	69	31
300mic	100	445	89	11
150	10	455	91	9
Residue	45	500	_	_
Total	500		314	_

Fineness Modulus FM = 314/100= 3.14 (ii) Bulk density= 1.01g/cc (iii) Specific gravity 2

TABLE.3. Chemical Properties Pond Ash

Si. No	**Compounds**	**% composition**
1	Silicon dioxide (SiO2) plus, Aluminium oxide (A12O3) Plus, Iron Oxide (Fe 2O3) percent by mass	79.97
2	Silicon dioxide (SiO2) percent by mass	36.22
3	Magnesium oxide (Mgo) percent by mass	2.73
4	Total sulphur as sulphur Tri oxide (SO3) percent by mass	0.69
5	Available alkalis as sodium oxide (Na203) percent by mass	2.12
6	Loss on ignition percent by mass	6.84
7	Moisture content percent by mass	1.78

Sieve Analysis For Quarry Dust (Grading)
(Conforming zone from IS383-1970)

By passing the sample downward through a series of standard sieves, each of decreasing size openings, the aggregates are separated into several groups, each of which contains aggregates in a particular size range.

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1.18	105	185	37	63
600mic	160	345	69	31
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150	10	455	91	9
Residue	45	500	_	_
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Mix Proportion For M_{20} Grade Concrete

TABLE.4.The Mix Proportion

Water	Cement	Fine aggregate	Coarse aggregate
191.58	**399.125**	**561.815**	**1185.394**
0.48	**1**	**1.408**	**2.969**

TABLE.5.Cement 30% Replaced By Pond Ash and Sand 100% replaced by Quarry Dust

Water	Cement	Pond ash	Fine aggregate	Coarse aggregate
191.58	**279.38**	**119.737**	**561.815**	**1185.394**
0.48	**0.7**	**0.3**	**1.408**	**2.969**

TABLE.6.Cement 35% Replaced By Pond Ash and Sand 100% Replaced By Quarry Dust

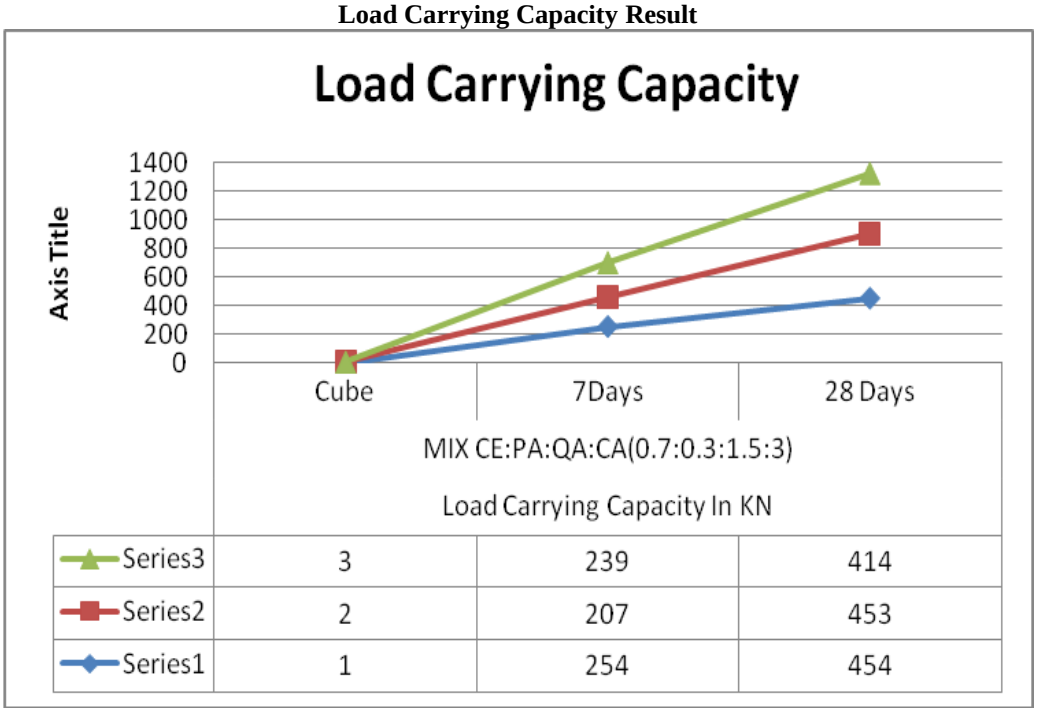
Water	Cement	Pond ash	Fine aggregate	Coarse aggregate
191.58	**259.43**	**139.69**	**561.815**	**1185.394**
0.48	**0.65**	**0.35**	**1.408**	**2.969**

TABLE.7. Cement 40% Replaced By Pond Ash And Sand 100% replaced by Quarry Dust

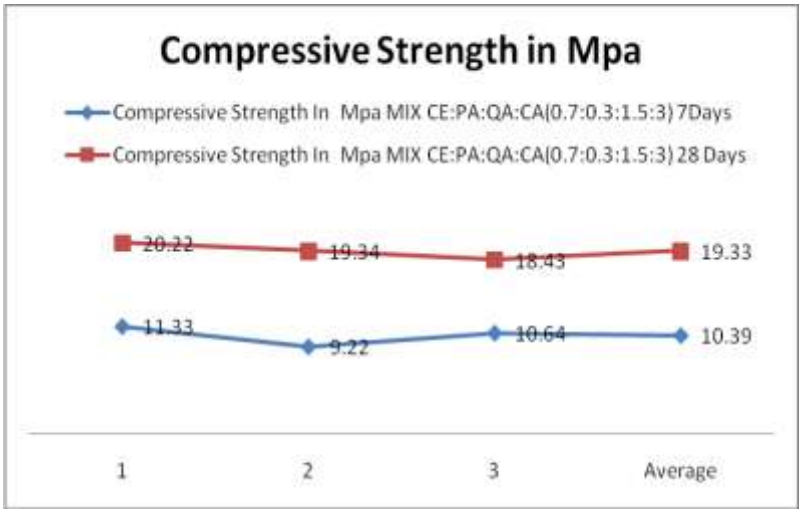
Water	Cement	Pond ash	Fine aggregate	Coarse aggregate
191.58	**239.47**	**159.65**	**561.815**	**1185.394**
0.48	**0.6**	**0.4**	**1.408**	**2.969**

Cement 30% Replaced By Pond Ash and Sand 100% Replaced By Quarry Dust

Load Carrying Capacity Result

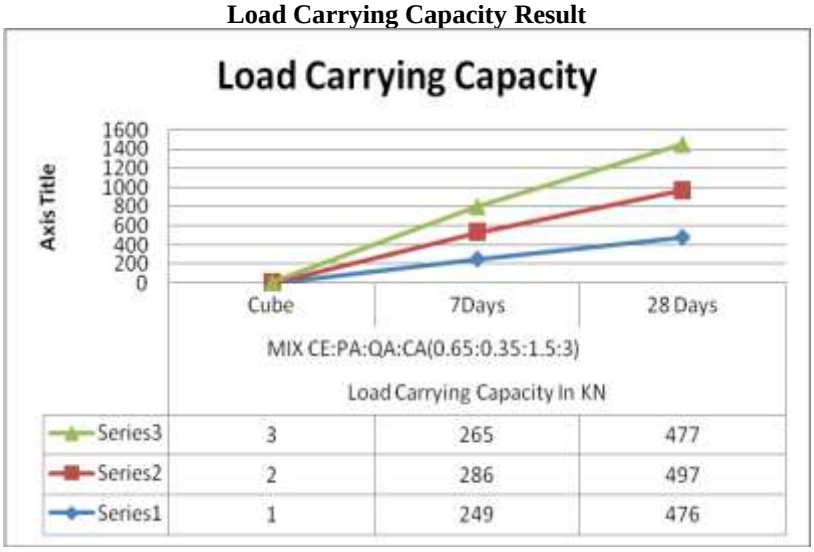


Compressive Strength Result

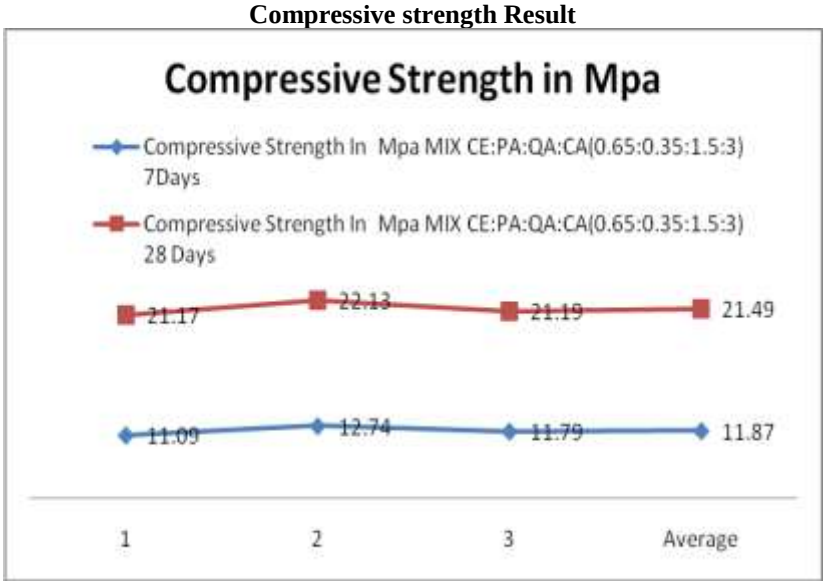


Cement 35% Replaced by Pond Ash and Sand 100% replaced by Quarry Dust

Load Carrying Capacity Result



Compressive strength Result



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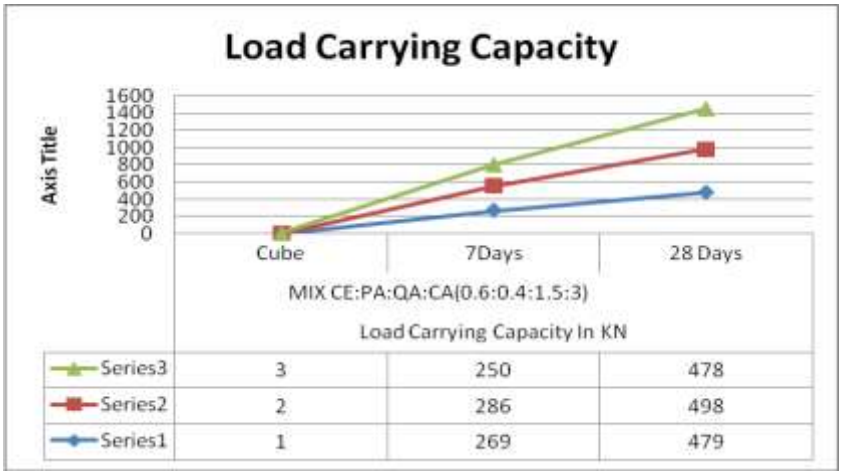
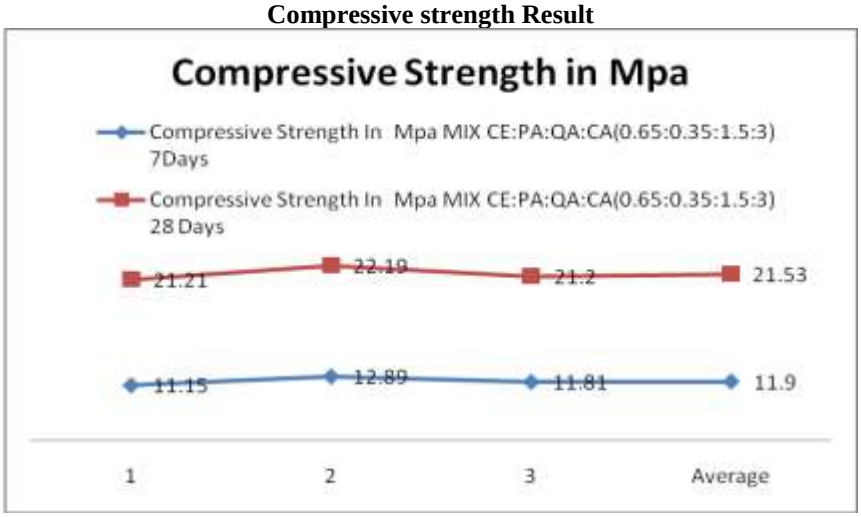


Compressive strength Result



III. CONCLUSION

The analysis of experimental data showed the reaction of Quarry Dust with pond Ash in concrete improved the strength.

- The disposal of Pond Ash should be maintained properly due to its unpozzolonic property.
- In this the effective use of Pond Ash can be reduced the hazardness to the environment. At the same, the economical utilization of Pond Ash and Quarry Dust should be followed.

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