MECHANICAL PROPERTIES OF STEEL FIBER REINFORCED CONCRETE WITH QUARRY DUST

G.Hymavathi
Assistant Professor, Department of Civil Engineering, NRI Institute of Technology, Perecherla, Guntur, AP, India.

A.Medhasri Mrunalini
Assistant Professor, Department of Civil Engineering, NRI Institute of Technology, Perecherla, Guntur, AP, India.

J. Sree Naga Chaitanya
Asst.Prof., Department of Civil Engineering, NRI Institute of Technology, Perecherla, Guntur, AP, India.
nriitchaitanya123@gmail.com

Dr. K. Chandramouli
Professor and Head, Department of Civil Engineering, NRI Institute of Technology, Perecherla, Guntur, AP, India. Email: koduru_mouli@yahoo.com

V.Venkata Chakradhar naidu
UG Scholar, Department of Civil Engineering, NRI Institute of Technology, Perecherla, Guntur, AP, India.
Email:chakri887naidu@gmail.com

Abstract

Today, concrete is a popular composite material. Coarse aggregate, fine aggregate, binding material and water are the components of concrete. The rapid expansion of construction operations has resulted in a lack of traditional construction supplies. Sand is commonly utilized as a fine aggregate in concrete. The most prevalent source of fine aggregate is river deposits. Natural river sand has become rare and expensive in recent years. If quarry dust is available near the construction site, construction costs can be effectively decreased. Quarry dust can be used entirely or partially in place of river sand. The study's notion of replacing natural fine aggregate with quarry dust could increase the consumption of quarry dust created by the quarry.It has been determined that quarry dust can be used as a fine aggregate replacement based on the findings of an experimental inquiry. It has been discovered that substituting quarry dust for fine aggregate at 40% yields the best results. Strength then normal concrete and then decreases from 50%. The compressive strength quantified for verifying percentage and grades of concrete for replacement of sand with quarry dust. This present work is an attempt to use Quarry Dust as partial replacement for sand in concrete along with the steel fibers. Attempts have been made to study the properties of concrete and to investigate some properties of quarry dust reinforced with steel fibers; this article presents the compressive and split tensile strengths of hook end steel fiber reinforced concrete with Quarry Dust. In the experimental work natural sand is replaced by Quarry dust in the proportions of 0%, 30%, and 60%. The hook end steel fibers were used in concrete by 0.5%, 0.75% volume fraction. After conduction of experiments on the cube and cylinder specimens, the results showed that, the incorporation of hook end steel fiber reinforced concrete with 30% Quarry dust for M30 grade concrete.

***Key words**: steel fibers, quarry dust*

1.Introduction

The engineering and construction materials must meet new and increased requirements. Other building materials like plastic, steel, and wood must compete with them in terms of productivity, economy, quality, and the environment. Concrete should be resistant to chemical attack, weathering action, and other deterioration processes in order to be durable. When exposed to the environment, durable concrete will maintain its original form quality and

functionality. These materials include conventional Portland cement as well as alternative cementation components including steel fibers and quarry dust. Biwa's and Davenport state that quarry dust is a by-product obtained during the crushing of stone (2002). Sulphides and iron oxides are the main components of a stone. The charge also contains oxides such as SiO_2, Al_2O_3, CaO and MgO, which are either presenting original concentrated. Steel fiber reinforced concrete is a composite material having fibers as the additional ingredients, dispersed uniformly at random in small percentages,i.e. between 0.3% and 2.5% by volume in plain concrete. Steel fibers are generally found to have aggregate much greater effect on the flexural strength of SFRC than on either the compressive or tensile strength, with increases of more than100% having been reported.

2. Objectives

To evaluate the compressive and split tensile strength of concrete, as well as to maximise the use of steel fibre reinforced concrete, fine aggregate, and quarry dust.

3.Materials

The properties of cement are presented in Table 1.

Table 1 Physical properties of cement

S. No.	Property	Cement (53 grade)
1	Specific gravity	3.142
2	Fineness	9.75%

3.1Quarrydust:

Quarry dust, a concentrated material used as aggregates for concreting purposes, particularly as fine aggregate, is a byproduct of the crushing process. Rock has been crushed into various sizes during quarrying activities; the dust produced during the process is referred to as quarry dust. Quarry dust has a similar range of particle sizes as sand, is grey in colour, and is granular in texture. Indian quarry dust has a specific gravity between 2.6 and 2.8 kg/m, which is nearly identical to the bulk density of typical fine aggregate. Specific gravity for quarry dustands was determined using tests that followed ASTM C128. When used as a sand substitute, quarry dust has a Specific Gravity of 2.75, which is greater than that of sand (2.6), according to the data shown in the table. The table also displays sieve analysis for various sand-to-quarry dust ratios. This indicates that quarry dust can require less water than sand does in the concrete mix.

3.2 Steel fibre reinforced concrete:

The term "steel fibre for reinforcing concrete" refers to short, discrete lengths of steel fibres with different cross-sections and an aspect ratio (ratio of length to diameter) between 20 and 100 that are small enough to be randomly dispensed in a mixture of unhardened concrete using common mixing materials. There have been reports of gains of more than 100% in the flexural strength of SFRC, which is often found to be far more affected by steel fibres than either the compressive or tensile strength. The ideal volume fraction for steel fibres is between 0.4% and 0.6%, which improves the qualities of concrete in terms of compressive strength, splitting tensile, flexural strength, abrasion, and absorption. 9. Increasing the toughness and maximum load and deflection by

adding steel fibres.

4. Experimental investigations

4.1 Compressive strength results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 2 .

Table2:Compressive strength of steel fibre reinforced concrete with quarry dust as partial replacement of fineaggregate in concrete.

Sl. no	Quarry dust	Compressive strength results,N/mm^2			
		7 days		28 days	
		For Steel 0.5 %	For Steel 0.75 %	For Steel 0.5 %	For Steel 0.75 %
	NC	34.33	34.33	49.07	49.07
1	0%	34.97	35.04	50.04	50.13
2	20%	35.38	35.77	50.70	51.25
3	40%	37.58	37.70	52.94	53.11
4	60%	35.74	35.58	50.82	50.92

4.2 Split tensile strength results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 3.

Table 3:Split tensile strength of steel fibre reinforced concrete with quarry dust as partial replacement of fineaggregate in concrete.

Sl. no	Quarry dust	Split tensile strength results,N/mm^2			
		7 days		28 days	
		For Steel 0.5 %	For Steel 0.75 %	For Steel 0.5 %	For Steel 0.75 %
	NC	3.39	3.39	4.85	4.85
1	0%	3.41	3.46	4.92	4.95
2	20%	3.41	3.50	4.96	5.01
3	40%	3.60	3.73	5.34	5.57
4	60%	3.45	3.51	4.95	5.03

5. Conclusion:

In this study, the concrete ingredients like fine aggregate are partially replaced by quarrydustand steel fibresrespectively. Quarry dustvarieddifferentpercentagesof NC0%,20%,40%,60%. andSteelfibresisvariedwithdifferentpercentageslike0.5%,0.75%.

1. At 40% replacement of fine aggregate by Quarry dust For Steel 0.5%the achieved compressive strength of concrete is 37.58 and 52.94N/mm^{2}for 7 and 28days.
2. At 40% replacement of fine aggregate by Quarry dust For Steel 0.75%the achieved compressive strength of concrete is is 37.70and 53.11N/mm^2 for 7 and 28days.
3. At 40% replacement of fine aggregate by Quarry dust For Steel 0.5%the achieved split tensile strength of concrete is 3.60 and 5.34N/mm^{2}for 7 and 28days.

4. At 40% replacement of fine aggregate by Quarry dust For Steel 0.75%the achieved split tensile strength of concrete is 3.73 and 5.57 N/mm^{2}for 7 and 28days.

6.References:

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