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Performance on Steel Fiber Concrete by Partial Replacement of quartz Powder and TiO_2

[1]Dr. K. Chandramouli, [2]J. Sree Naga Chaitanya, [3]G. Hymavathi, [4]A. Medha Sri Mrunalini, [5]Patan Nurulla Khan

[1]Professor & HOD, [2,3&4]Assistant Professor, [5]B. Tech Student; all are attached with Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA.

Corresponding Author: Email:sreenagachaitanya@gmail.com

ABSTRACT

Every construction project in the world uses concrete as a building material. These projects include every conceivable problem in terms of durability, exposure to different reactive chemicals, and at a position where concrete needs to be high strength. Based on the kind and content of the elements employed, the concrete is a heterogeneous combination that is intended to solidify and provide strength. To achieve this high strength, we have used materials like steel fibres, TiO2 as a partial replacement for cement, and quartz powder as a partial replacement of fine aggregate. In this study, we are conducting an experimental investigation to see whether there is any possible increase in the strength of nominal concrete to change to high strength concrete. On materials, freshly-poured concrete, and hardened concrete, we've run a number of experiments.We have also examined other studies that were conducted on projects comparable to this one using relevant resources. We have used a variety of material ratios, such as 10 percent, 20 percent, 30 percent, 40 percent, and 50 percent of quartz powder replacing some of the fine aggregate, 0 percent, 0.5 percent, 1.0 percent, and 1.5 percent of TiO2 replacing some of the cement, and 0 percent, 0.5 percent, 1 percent, 1.5 percent, and 2 percent of steel fibres added to the concrete.

Keywords: Ggbs, Tio_2, compressive, split tensile strength.

INTRODUCTION

Concrete is a material used in building, and in order to produce and utilise it, certain requirements must be followed. Concrete is made up of cement, coarse aggregate, fine aggregate, water, and additives. These components will come together to create concrete. For some rare instances, high strength concrete was required, therefore additional contents were added while some concrete constituents were partially replaced.

Ordinary concrete, which is made up of these common ingredients, will produce concrete with a moderate strength. most popular modern answer to the issues of using nominal concrete in building is the use of high strength concrete. Concrete will have a high strength when TiO2 is used to partially replace cement in addition to acting as a toxic agent or hazardous gas collector. The use of steel fibres will often result in stronger concrete than regular concrete. Closing voids and producing better compact concrete will come from using quartz powder to partially replace the fine aggregate.

OBJECTIVES

1. To use cement with TiO2 as efficiently as possible
2. To research how steel fibres affect concrete behaviour.
3. To investigate the strength characteristics of concrete using TiO2, steel fibres, and quartz powder.

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	3.156
2	Fineness	9.73%

Titanium dioxide:

A naturally occurring compound made of titanium and oxygen is known as titanium dioxide. It's an inorganic substance. This substance offers concrete excellent flexural strength and gives it a white hue.

Steel Fibers:

Steel fibres are small steel particles that are added to concrete to increase its strength. They range in size from 3 to 6 mm in diameter to 4 to 6 mm in length, and they come in a variety of shapes, including hooked, crimped, and twisted fibres.

QUARTZ POWDER: -

When quartz, a crystalline component, is added to concrete, it strengthens the concrete by serving as a filler for voids and a strength-boosting agent. When crushed, quartz produces a white coloured powder with a rough texture and a chemical formula of SiO_2.

EXPERIMENTAL RESULTS

4.1Compressive strength

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 2 to 4.]

Table 2: Compressive strength of concrete with quartz powder as partial replacement of fine aggregate in concrete

Sl.no	%Of quartz powder	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	34.50	49.57
2	10%	35.27	51.24
3	20%	35.96	52.66
4	30%	36.47	53.72
5	40%	38.67	54.86
6	50%	35.67	53.32

Table 3: Compressive strength of concrete with Tio_2 in concrete

Sl. No	Tio_2	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	34.50	49.57
2	0.5%	37.91	56.08
4	1%	40.66	57.76
5	1.5%	37.99	57.14

Table 4: Compressive strength of concrete with steel fibers in concrete

Sl.No	Hooked steel fibres	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	34.50	49.57
2	0.5%	38.69	56.32
3	1%	41.35	60.99
4	1.5%	47.34	67.25
5	2%	44.97	64.44

Table 5: Split tensile strength of concrete with quartz powder as partial replacement of fine aggregate in concrete

Sl. No	%Of quartz powder	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	3.42	4.95
2	10%	3.83	5.60
3	20%	3.59	5.15
4	30%	3.71	5.31
5	40%	3.90	5.54
6	50%	3.38	5.27

Table 6: Split Tensile strength of concrete with Tio_2 in concrete

Sl. No	Tio_2	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	3.42	4.95
2	0.5%	3.69	5.43
4	1%	4.07	5.68
5	1.5%	3.67	5.50

Table 7: Split tensile strength of concrete with steel fibers in concrete.

Sl.no	Hooked steel fibres	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	3.42	4.95
2	0.5%	3.80	5.61
3	1%	4.01	6.01
4	1.5%	4.75	6.79
5	2%	4.38	6.27

Table 8: -Compressive strength of Concrete with QP, HSF &TiO_2

Sl. No	QP+Tio_2+HSF	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	34.50	49.57
2	40%QP+1%Tio_2+1.5%HSF	52.13	74.69

Table 9: -Split strength of Concrete with QP, HSF &TiO_2

Sl. No	QP+Tio_2+HSF	7 days (N/mm^2)	28 days (N/mm^2)
1	0%	3.42	4.95
2	40%QP+1%Tio_2+1.5%HSF	5.15	7.39

CONCLUSION

In this study, the concrete ingredients like cement are partially replaced by TIO_2 and fine aggregates is partially replaced by quartz powder and addition of steel fibers to concrete respectively. Quartz powder varied different percentages of 0 % , 10%, 20%,30%,40%, 50% .and TIO2 is varied with different percentages of0%,0.5%,1%,1.5%, and hooked steel fibers varied with percentages of 0%, 0.5%, 1%, 1.5%, 2%.

- At 40% partial replacement of quartz powder with fine aggregate the compressive strength of concrete at 7 and 28 days are 38.67 and 54.86 N/mm^2.
- At 40% partial replacement of quartz powder with fine aggregate the split tensile strength of concrete at 7 and 28 days are 3.90 and 5.54 N/mm^2.
- At 1% partial replacement of titanium dioxide with cement the compressive strength of concrete at 7 and 28 days are40.66 and 57.76 N/mm^2.
- At 1% partial replacement of titanium dioxide with cement the split tensile strength of concrete at 7 and 28 days are4.07and 5.68 N/mm^2.
- At 1.5% addition of hooked steel fibers to concrete the compressive strength of concrete at 7 and 28 days are 47.34and 67.25N/mm^2.
- At 1.5% addition of hooked steel fibers to concrete the split tensile strength of concrete at 7 and 28 days are 4.75 and 6.79 N/mm^2.
- By the combination of 40% quartz powder +1% Tio_2+1.5% steel fibers with concrete the compressive strength of concrete at 7 and 28 days are 52.13 and 74.69N/mm^2.
- By the combination of 40% quartz powder +1% Tio_2+1.5% steel fibers with concrete the split tensile strength of concrete at 28, 56 and 90 days are 5.15 and 7.39N/mm^2.

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