

Effect of Aggregate Type on the Compressive Strength of Concrete with and without using Super-Plasticizer

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Abstract— In construction industry concrete made has its own priority above all constructional materials in the ancient time lime was used as a binder material for construction, but as time elapses concrete took his place as a binder and its wide use makes it important. It has different properties which plays an important role among them compressive strength is the most essential one as more is the strength more will be its capacity to hold live load on it after it hardens. As we know concrete constitute of cement, sand and coarse aggregate and coarse aggregate have the maximum volume of the concrete, so on some aspect its quality may also affect the properties of concrete. Granite gravel and crushed quartzite were used as a coarse aggregate in concrete for M40 mix and design mix was as per IS: 10262-2009 and with both type of coarse aggregate super plasticizer was also used. Hence for specimens of granite gravel with and without admixture and specimen of crushed quartzite with and without admixture suggested crushed quartzite is also appropriate for making concrete by using it as a coarse aggregate without admixture.

Key words: Super-Plasticizer, Granite Gravel

I. INTRODUCTION

On an average estimation it can be concluded that concrete of about 5 billion cubic yard are used annually and the annual production of concrete is regarding 2 tons per person on our planet. This fact shows the importance of concrete and makes it essential to enhance the properties of concrete on some parameters. In this study the effect of aggregate type on the compressive strength of concrete has been investigated by using two types of coarse aggregate one was granite stone gravel and in comparison of that crushed quartzite was used. Institutional tap water was used having pH value of about 7 which is potable water. Sample specimen were prepared in two categories and in each category two sub category were categorized one sample specimens were with admixture that is super plasticizer and other test sample specimen without admixture (super plasticizer), under each sub category 9 specimen were made, set of 3 specimen of each 7 days, 14 days and 28 days compressive strength check. Hence 36 specimen were prepared in all and the mould was 150mmX150mmX150mm in size for preparing specimen. The design mix was done for M40 grade of concrete by taking it pump able concrete according to IS: 456-2000 and workability was 50mm-100mm in range for pump able concrete. Full water immersing curing were provided to the samples, crushed quartzite which was used in replacement of granite gravel in frequently used for railway ballast having high impact value and minimum water absorption.

Super plasticizer which were used was Conplast SP430 G8 which is an admixture available in market by fosroc industry product and it complies with the code IS : 9013-1999 and BS : 5075 part-3, having specific gravity of

about 1.24-1.26 with no chloride content with its use water reduction can be done without losing workability of concrete and is compatible in use with almost every type of cement expect high alumina cement. For this work OPC 53 grade cement was used conforming to IS: 12269-1987 and sand was of zone-2, For moulding and casting of concrete IS 516:1959 had been used. For determining the setting time of concrete penetration test will be done as per IS: 8142-1976 and for testing the workability of concrete slump cone test will be done by slump test apparatus as per IS: 7320-1974. Nominal mix 1:2:4 is adopted for this work and mix composition is calculated as per IS:10262-2009 .

II. MATERIALS AND METHODOLOGY

This experiment investigation was performed for evaluating the probability of crushed quartzite aggregate in concrete. We have conducted various test summarizing water absorption test, impact value test, specific gravity of granite gravel and crushed quartzite stone for marking the better for concrete. The cement, sand, admixture and water which were used are:

- 1) Cement - ordinary Portland cement of 53 grade conforming to IS: 12269-1987
- 2) Sand - sand of zone-2
- 3) Admixture -super plasticizer admixture was used Conplast SP430 G8
- 4) Water - Institutional water having pH value of 7 that is potable for drinking

III. DESIGN MIX

- Concrete grade = M40
- Cement grade = ACC cement of OPC 53
- Maximum nominal size of coarse aggregate = 20 mm
- Cement content (minimum) = 320 kg/m³ (according to IS: 456-2000 , table 5 , reinforced concrete)
- W/C ration maximum = 0.45
- Workability required = 75-100 (from clause 7.1 , IS:456-2000)
- Exposure condition for concrete = Severe (table 3 , IS:456-2000)
- Concrete placing method = Pump able
- Type of aggregate = Gravel of crushed angular shapes
- Maximum cement content = 450 kg/m³
- Specific gravity of cement used = 3.15
- Specific gravity for coarse aggregate = 2.87 for granite gravel and 2.64 for crushed quartzite
- Specific gravity for fine aggregate = 2.74
- Water absorption for coarse aggregates = 0.9 % for granite gravel and 0.5 % for quartzite
- Water absorption for fine aggregates = 1.5 %
- Specific gravity of admixture = 1.24

Material	Mass of Granite Gravel Per M ³	Mass of Quartzite Per M ³
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	With Admix	Without Admix	With Admix	Without Admix
Cement	438.13	350.5	438.13	350.5
Water	197.16	157.73	197.16	157.73
Coarse Aggr.	1046.22	1150	963	1057.45
Fine Aggr.	821	902	821	902
Admixture	0	1.753	0	1.753

Table 1: Material

IV. MIX PROPORTIONING

Aggregate Type Sample	Mix Proportion	
Granite Gravel	Without Admixture	1:1.87:2.39
	With Admixture	1:2.57:3.28
Quartzite	Without Admixture	1:1.87:2.2
	With Admixture	1:2.57:3.02

Table 2: Mix Proportion

V. RESULTS AND DISCUSSION

A. Granite Gravel Samples Compressive Strength Test Results

Test Details	Unit	Characteristic Compressive Strength (FCK) Without Admixture					
Age of Specimen	Days	7		14		28	
Specimen Id	-	B-1	B-2	B-1	B-2	B-1	B-2
Maximum Failure Load	KN	410	405	710	650	850	840
Compressive Strength	N/m ²	18.22	18	31.56	28.89	37.78	37.34
Average Strength	N/m ²	18.11		30.23		37.56	

Table 3: Granite Gravel Samples Compressive Strength Test Results

Test Details	Unit	Compressive Strength (FCK) With Admixture of 0.5 % By Wt. Of Cement					
Age of Specimen	Days	7		14		28	
Specimen Id	-	B-1	B-2	B-1	B-2	B-1	B-2
Maximum Failure Load	KN	460	450	590	610	750	710
Compressive Strength	N/m ²	20.44	20.00	26.23	27.12	33.34	31.56
Average Strength	N/m ²	20.22		26.68		32.45	

Table 4: Granite Gravel Samples Compressive Strength Test Results

- 1) When 7 days compressive strength is compared of specimen prepared by using granite gravel it was found that the specimen prepared with admixture gives better result.
- 2) At 14 days compressive strength test it was noticed that there is more increment of strength in

specimens containing no admixture which is of 66.92 % and on other hand there is increment of strength of 31.94 % only containing admixture.

- 3) On the compressive strength test conducted at 28 days on both the specimens the specimen containing no admixture had 15.74 % more strength than specimens with admixture.

B. Quartzite Samples Compressive Strength Test Results

Test Details	Unit	Characteristic Compressive Strength (Fck) Without Admixture					
Age Of Specimen	Days	7		14		28	
Specimen Id	-	R-1	R-2	R-1	R-2	R-1	R-2
Maximum Failure Load	Kn	510	525	850	810	1200	1220
Compressive Strength	N/M m ²	22.67	23.34	37.78	36.00	53.33	54.22
Average Strength	N/M m ²	23.00		36.89		53.78	

Table 5: Quartzite Samples Compressive Strength Test Results

Test Details	Unit	Characteristic Compressive Strength (Fck) With Admixture Of 0.5 % By Wt. Of Cement					
Age Of Specimen	Days	7		14		28	
Specimen Id	-	R-1	R-2	R-1	R-2	R-1	R-2
Maximum Failure Load	Kn	485	490	520	535	860	890
Compressive Strength	N/M m ²	21.56	21.78	23.11	23.78	38.22	39.56
Average Strength	N/M m ²	21.67		23.45		38.89	

Table 6: Quartzite Samples Compressive Strength Test Results

- 1) The overall strength results at 7 days, 14 days, 28 days for quartzite specimens containing no admixture is much more than admixture containing specimens.
- 2) The increment of strength are 6.13 % , 57.31 % , 38.28 % at 7 days, 14 days and 28 days respectively in specimens containing no admixture in comparison of specimens containing 0.5 % admixture.

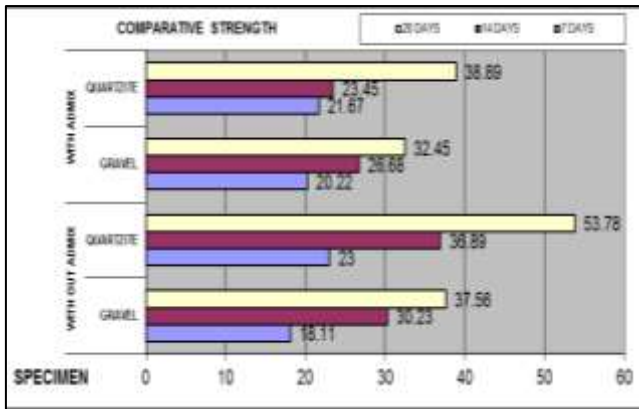


Fig. 1: Graph

VI. FUTURE SCOPE OF STUDY

As concrete is a broad field to be researched still, yet number of researches has been done on it and are going on too. But from this research work various further scope for the researchers can be concluded that :

- Combination of both the aggregates can be done and the specimens can be prepared and cured and then tested for the compressive strength and comparison between individuals specimens test results can be done.

Also the other parameters can be compared from the specimen prepared from different aggregates such as durability etc.

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