EFFECT OF DIFFERENT TYPES OF COARSE AGGREGATES ON PHYSICAL PROPERTIES OF MOSTLY USED GRADES M20, M25, M30 OF CONCRETE

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ABSTRACT

Aggregates are inert granular materials such as sand, gravel, or crushed stone that, along with water and binder (cement/blended cement), are an essential ingredient in concrete. For a good concrete mix, aggregates need to be clean, hard, strong particles free of absorbed chemicals or coatings of clay and other fine materials that could cause the deterioration of concrete with required shape and size. Aggregates, which account for 60 to 75 percent of the total volume of concrete, are divided into two distinct categories--fine and coarse. The most important property of concrete is its compressive strength. For the purpose of comparison of such compressive strength, three types of coarse aggregates, quartzite, Granite and river gravel were use. The fine aggregate is normal sand obtained from a borrow pit.

This experimental investigation describe the influence of aggregate type and size on concrete density compressive and split tensile strength of concrete. Three different type of coarse aggregates used for developing mix design. The size of coarse aggregate of 40mm, 20mm, 12mm. OPC is intended to be used as binding material and tests are carried out after 7 and 28 days.

Keywords: ***Concrete, Aggregates, Coarse Aggregate, Fine Aggregate, Slump, Compressive Strength, Models and Workability***

I. INTRODUCTION

The compressive quality of cement relies upon the w-c proportion, level of compaction, proportion of concrete to aggregate, bond amongst mortar and total, and reviewing, shape, quality and size of the aggregates. Cement can be imagined as a multi-stage composite material made up of three stages; specifically the mortar, mortar/total interface, and the coarse total stage. The coarse aggregate in typical cement is basically from shake pieces portrayed by high quality. Subsequently, the Aggregate interface is not a constraining variable administering the quality necessity .The beginning of disappointment is showed by break development in the solid. For ordinary cement the split development is principally around the concrete glue or at the total/bond glue interfacial zone. The quality of cement at the interfacial zone basically relies upon the honesty of the concrete glue and the idea of the coarse total.

This paper reports the aftereffect of an examination embraced to explore the impact of three unique sorts and sizes of coarse total on the compressive quality and split elasticity of typical cement. The impact of utilizing quartzite, rock, and waterway rock as coarse total on the physical properties of cement was examined .The result of the investigation uncovered that the quality of cement for a given water/bond proportion rely upon the sort and size of aggregate.

II. LITERATURE REVIEW

Total sort has impact on the compressive quality of typical cement. Most astounding compressive quality was accomplished from all evaluations of cement containing 12mm Quartzite, trailed by concrete containing Granite and waterway rock or River Gravel.

- The Relationships between Setting Time and Early Age Strength of Concrete containing Silica fume, Fly ash and Slag", Third International Conference on Sustainable Construction Materials and technologies. On the basis of above studies, an attempt has been made in the present investigation was to study on Effect of three aggregate types with different sizes and grades on concrete and 35% replacement of cement by flyash. By **Mahmoud Nili, Mohsen Tadayon, Mojtaba Nili.**
- effect of coarse aggregate type on mechanical properties of concretes with different strength cement and concrete research Vol 27 issue 2 papers 165-170. By **Ozuturan T and Cecen C (1997).**
- Total sort has impact on the compressive quality of typical cement. Most astounding compressive quality was accomplished from all evaluations of cement containing 12mm Quartzite, trailed by concrete containing Granite and waterway rock or River Gravel Nominal blend was received for this work and blend sytheses were computed by outright volume technique. For each sort of coarse total 75 Cubes (150x150mm) were thrown to enable the compressive quality to be observed at 3, 7, 14, 21, and 28 days. By **Abdullahi. M Civil Engineering Department,** In "International Journal Of Civil And Structural Engineering Volume 2, No 3, 2012".

III. EXPERIMENTAL INVESTIGATION

An Experimental Investigation results in various process of material testing. Materials, Mix proportioning, casting, curing and testing of specimen is carried here. The following sections are the various physical and chemical properties of the separate materials.

3.1 Mix Proportions

The mix proportioning was done according to the Indian Standard Recommended Method IS: 10262-2009. The target mean strength was 48.25 MPa for the control mix, the total cement content was 450 kg/m^3, fine aggregate of 576.734 kg/m^3 is taken and coarse aggregate of 1101.156kg/m^3 is taken, the water to cement ratio was kept as 0.40, the Super plasticizer content was taken as per workability requirement. The total mixing time was approximately 5 minutes, the samples were then casted. Shown in Mix Design.

3.2 Preparation and casting of test specimens

The experimental program consisted of casting and testing specimens for testing the fresh and hardened properties on M40 grade of concrete with fly ash as replacement for fine aggregate in concrete with and without basalt fibre content. Cement, sand, fly ash and coarse aggregate were properly mixed together in accordance with IS code before adding water and later water is added and are properly mixed together to achieve homogenous material.

For the mixes with fibres, the basalt fibres are added to the wet concrete, and it should not be allowed to mix for more than 2 minute, otherwise fibres will get segregated.

3.3 Materials

The materials used in the experimental investigation of Basalt Fibre Reinforced Fly ash Concrete (BFRFC) are Ordinary Portland cement-53 grade, Coarse Aggregates (Quartzite, Granite, River Gravel), River sand, Flyash, Water, Chemical Admixtures – super plasticizer [Conplast SP430(DIS)].

3.3.1 Cement

Ordinary Portland cement of 53 grade [IS: 12269-1987, Specifications for 53 Grade Ordinary Portland cement] has been used in the study. It was procured from a single source and stored as per IS: 4032 – 1977.

3.3.2 Fine Aggregates

The fine aggregate used was locally existing river sand deprived of any organic foams and conforming to IS: 383 – 1970 [SPECIFICATION FOR COARSE AND FINE AGGREGATES FROM NATURAL SOURCES FOR CONCRETE]. The fine aggregate was verified for its physical requirements such as gradation, fineness modulus, specific gravity and bulk density in accordance with IS: 2386 – 1963 [Methods of test for aggregate for concrete] Shown in Table 1.

3.4 Fly Ash

It was procured from a single source i.e. from APARNA CONSTRUCTIONS pvt Ltd. and stored carefully. The fly ash was tested for its physical requirements such as gradation, fineness modulus, specific gravity as per IS: 1727 – 1967[METHODS OF TEST FOR POZZOLANIC MATERIALS]. The physical properties of Flyash are tabulated in Table 2.

3.5 Water

The pH value of water should be in between 6.0 and 8.0 according to IS 456-2000. As per recommendation of IS: 456 (2000), the water used for mixing and curing must be clean and free from substances that may be deleterious to concrete or steel.

3.6 Super Plasticizer

These are the advanced kind of water diminishing admixtures , essentially a synthetic or a blend of chemicals that grant higher workability to concrete. The physical properties of Super plasticizer are tabulated in Table 3.

3.7 Workability

The property of concrete which determines the amount of useful internal work necessary to produce complete compaction.

Table 1:Physical Properties of Fine aggregates

S. No	Property	Test Results
1.	Fineness	2.6
2.	Grading zone	II
3.	Specific gravity	2.42
4.	Water absorption (%)	1.0 %

Table 2: Physical properties of fly ash

S. No	Property	Test Results
1.	Specific gravity	2.3
2.	Fineness Modulus	3.14

Table 3: Physical properties of super plasticizer

S. No	Property	Test Results
1.	Form	Liquid
2.	Color	Brown
3.	Specific gravity	1.20 to 1.22 at 30^0C
4.	Dosage	0.6 - 1.5 litres /100 kg cement

IV. MIX DESIGN

Details of these mixes are presented in the mix proportions are as follows,

M20 Grade of Concrete

M_{20} w/c=0/4	Size of Aggregate	Cement	Fine Aggregate	Coarse Aggregate
Quartzite	12mm	1	1.419	2.282
	20mm	1	1.641	2.67
	40mm	1	1.804	2.94
Granite	12mm	1	1.36	2.18
	20mm	1	1.63	2.67
	40mm	1	1.97	3.23
River Gravel	12mm	1	2.08	3.19
	20mm	1	1.63	2.68
	40mm	1	1.97	3.23

M25 Grade of Concrete

M_{25} w/c=0/4	Size of Aggregate	Cement	Fine Aggregate	Coarse Aggregate
Quartzite	12mm	1	1.75	2.9
	20mm	1	1.39	2.36
	40mm	1	1.683	2.86
Granite	12mm	1	1.75	2.92
	20mm	1	1.39	2.36
	40mm	1	1.685	2.878
River Gravel	12mm	1	1.175	2.79
	20mm	1	1.39	2.38
	40mm	1`	1.68	2.89

M30 Grade of Concrete

M_{30} w/c=0/4	Size of Aggregate	Cement	Fine Aggregate	Coarse Aggregate
Quartzite	12mm	1	1.08	1.90
	20mm	1	1.25	2.23
	40mm	1	1.51	2.68
Granite	12mm	1	1.08	1.89
	20mm	1	1.25	2.23
	40mm	1	1.51	2.69
River Gravel	12mm	1	1.08	1.80
	20mm	1	1.25	2.24
	40mm	1	1.51	2.68

3.3 Mixing Of Concrete, Casting And Curing Of Test Specimens

Mixing was done using tilting mixers of capacity 40lts. Initially the dry mix constituents of cement, fine aggregate and coarse aggregate was mixed for two minutes and then the water with chemical admixtures were added and mixing continued for another 2 minutes. The total mixing time was kept at 5 minutes approx. for all the trials until a homogeneous mixture was obtained. Compaction was achieved by using needle vibrator and then specimens were casted. All specimens were demolded after 24 hours and placed in curing tanks till the day of testing i.e. for 7 & 28 days.

3.4 Tests On Concrete

Test methods include the tests of fresh concrete mix for workability and hardened concrete specimens for compressive and split tensile strength test.

3.5 Workability Test

Slump test for fresh concrete was done conforming IS : 1199-1959 in order to measure the workability of concrete mixes.

3.6 Compressive Strength

In this investigation, the cube specimens of size 150x150x150mm are tested in accordance with IS: 516 – 1969. After 7 &
28 days of curing, cube specimens were removed from the curing tank and test for compression. The test was repeated for the three specimens and the average value was taken as the mean strength. Values are tabulated in table 7.

3.7 Split Tensile Strength

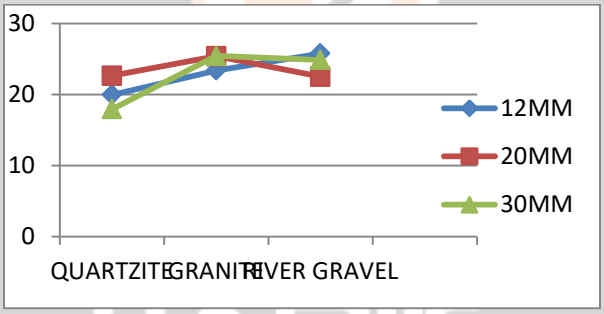
*i*n this test concrete cylinders of size 150 mm diameter and 300 mm height are tested in accordance with is: 5816 -1999. the split tensile strength reported is the average of three results obtained from 3 identical cylindrical specimens. split tensile strength is calculated by the following formula and values are given in table 8. fs =2p/πdl where (fs) is the splitting strength (mpa), p = failure load (kn), l = length of cylinder(mm) and d = diameter of cylinder (mm).

Test Results

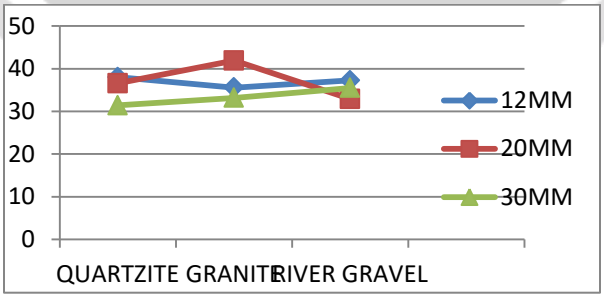
N/mm^2		Quartzite			Granite			River Gravel		
		12mm	20mm	40mm	12mm	20mm	40mm	12mm	20mm	40mm
M20	7 days	19.95	22.65	17.92	23.39	25.40	25.44	25.77	22.51	24.88
	28 days	38	36.59	31.4	25.55	41.92	33.18	37.26	32.9	35.48
M25	7 days	25.92	27.55	25.18	28.59	26.37	21.62	26.22	20.44	21.63
	28 days	46.96	39.7	46.52	46.77	43.03	28.88	27.55	30.51	26.41
M30	7 days	26.22	28.93	24.66	28.81	26.44	28.14	25.33	21.22	21.04
	28 days	35.55	36.66	34.07	39.14	43.14	44.44	37.77	34.22	34.77

Compressive Strength Results of M20 for 7 and 28 days

For 7 days

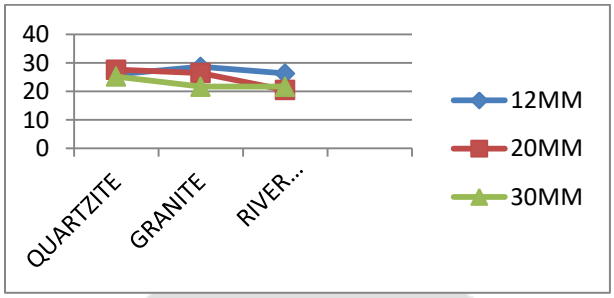


For 28 days

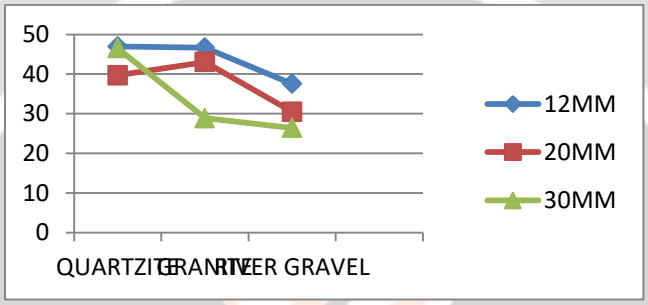


Compressive Strength Results of M25 for 7 and 28 days

For 7 days

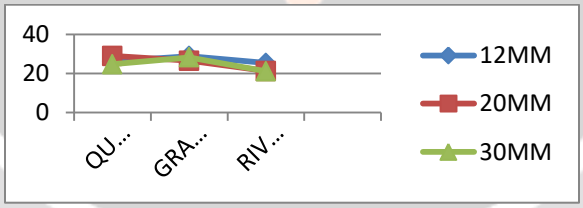


For 28 days

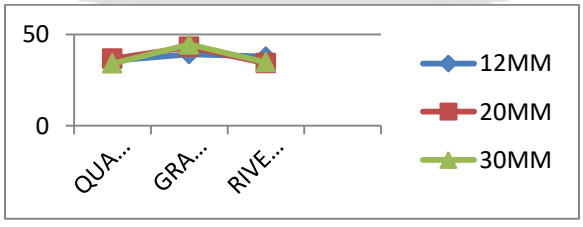


Compressive Strength Results of M30 for 7 and 28 days

For 7 days



For 28 days



V. CONCLUSION

Aggregate type has effect on the compressive strength of normal concrete. Maximum compressive strength was achieved from all grades of concrete containing 12mm Quartzite, followed by concrete containing Granite and river gravel. Concrete containing River Gravel shows the smallest strength development at all ages. It is suggested that quartzite aggregate may be employed for concrete work in places where concrete practitioners have variety of choices available.

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5. Ozuturan T and Cecen C (1997) effect of coarse aggregate type on mechanical properties of concretes with different strength cement and concrete research Vol 27 issue 2 papers 165-170

LIST OF REFERED STANDARD CODES

1. IS: 456 – 2000 Code of practice for plain and reinforced concrete (fourth revision).
2. IS: 12269-1987 Specifications for 53 Grade Ordinary Portland Cement.
3. IS: 383- 1970 Specification for Coarse and fine aggregates from natural sources for concrete.
4. IS: 5514 – 1996 Specification for apparatus used in Le-chatelier test (first revision).
5. IS: 5513 – 1996 Specification for vicat apparatus (second revision).
6. IS: 2386 – 1963 (all parts) Methods of Test for Aggregate for Concrete.