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Ultra High Strength Concrete by Using Alccofine (1203)

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Abstract: This paper presents an examination on the advancement of ultra high strength concrete by adding alccofine 1203 and Quartz powder. The compressive strength of concrete is 42.10, 85.33 and 121.94N/mm² at 3, 7 and 28 days. The split tensile strengths are 4.11, 8.29 and 11.90N/mm² at 3, 7 and 28 days.

Index Terms - Alccofine-1203, Compressive strength, Split tensile strength.

I. INTRODUCTION

Ultra high strength concrete has developed continuously due to the increasing load and movement of people from rural to urban and industrialization. Understanding of the micro structure and its behavior of materials involved in concrete's production and the utilization of new materials. Concrete technology has demanded by engineering projects which paved the way to higher tensions in order to achieve high strength concrete for instance. The main constituents of UHSC are cement, sand, silica fume, steel fiber and quartz powder with minimal water to binder ratio, without coarse aggregate. This new concrete type has compressive strengths of 100-230 N/mm² depending on the type and amount of fibers used. The behavior of structural elements is related through references to several experimental studies and its conclusions.

II. LITERATURE REVIEW

Reactive powder concrete

Kiran.T and N Jayaramappa (2017)

Reviews of several literatures have made to understand the behaviour of reactive powder concrete. It is observed that Reactive powder concrete have compressive strength ranging from 200 to 800MPa. The reactive powder concrete has properties like reduction in aggregate size, enhanced mechanical properties, reduction in aggregate to matrix ratio. The durability of RPC was better than HPC, such as abrasive wear, water absorption, corrosion; chloride ion diffusions are lower than HPC. RPC having the reduction in the total quantity of material consumed and the use of recycled materials in ductile RPC provides improve seismic performance by reducing inertia loads with lighter members, allowing larger deflection with reduced cross section and providing higher energy absorption. The extremely low levels of water and chloride ions indicate the potential FRPC as good material for storage of nuclear waste. RPC concrete can be used in construction of nuclear plants because of its high impermeable nature.

Study on alccofine (1203) based high performance concrete

G.Srinivasan (2020)

In this present scenario of construction practice, new materials are being used as additive to the High Performance Concrete. Alccofine 1203 is one of such additive which proposed to use, in order to increase the compressive strength and durability of concrete. Alccofine 1203 is primarily composed of low calcium silicates which is processed and obtained through controlled particle size distribution (PSD). When compared to cement, the particle size distribution and specific gravity of Alccofine 1203 is higher and lower respectively, thus making more suitable as an additive to cement. In this thesis, it is proposed to study the Alccofine based high performance concrete with various proportions. M50 grade of concrete is planned to study by their mechanical properties such as compressive strength, flexural strength, elastic modulus of concrete and other durability properties. For all the tests, standard experiments are followed to determine the properties as per Indian standards. The results are presented and discussed. It is observed that 10% Alccofine added with the cement is giving increase in strength

III. OBJECTIVE

The objectives of this experimental work are as follows,

1. To increase compressive strength of UHSC and tensile strength of UHSC.
2. Using of steel fibers to arrest the cracks developed in the concrete.

IV. MATERIALS

- CEMENT
- ALCCOFINE (1203)
- QUARTZ POWDER
- WATER
- STEEL FIBRE
- SUPERPLASTICIZER (Polyacrylate)
- FINE SAND (150-400 MICRONS)

a. Cement

Cement is mainly used as a binder material in concrete which is used for construction that sets, hardens to other materials bind together. OPC (ordinary Portland cement) of 53 grade is used in construction purpose and its properties presented in table 1.

Table 1. Physical Properties of OPC

S.No	Description of item	Values
1	Specific gravity	3.14
2	Fineness modulus	9%
3	Water absorption	3%
4	Consistency	32
5	Initial setting time	41 minutes
6	Final setting time	498 minutes

b. Alccofine(1203)

Alccofine (1203) is a low calcium silicate material which improves the workability and compressive strength due to granulation and high glass content.



Fig:Alccofine (1203)

Table 2: Physical properties of Alccofine

Physical Properties	Result
Physical state	Micronized powder
Odour	Odour less
Appearance	White colour powder
Colour	White
Bulk density(kg/m ³)	600-700
Particle size	4 to 6
Specific gravity	2.86

b. Steel fibers

Steel fiber in concrete can cause qualitative changes in concrete's physical property, greatly increasing resistance to cracking, impact, fatigue, and bending, tenacity, durability and other properties. The properties are presented in table 3.

Table 3: Steel fibers size and properties

	Steel fibers type	Length	Diameter	Density	Tensile strength
Long fibers	65/60	60	0.90	7.85	1160

V. CONCRETE MIX DESIGN

The mix proportion referred from Research paper A study on Reactive Powder concrete by Kiran.T and N Jayaramappa and mix proportion of concrete in table 4.

Table 4: Mix proportion of concrete

Materials	Mix Proportion(kg/m ³)
Cement	1000
w/b	0.20
Silica fume	225
Aggregate (2.36 – 1.18mm)	700
Aggregate (1.18mm – 600 μ)	150
Aggregate (0 - 600 μ)	100
Quartz powder	253
Steel fibers	30.60
Water	245
Super plasticizer	49

VI. EXPERIMENTAL RESULTS

a. Compressive strength of concrete

The compression tests were carried out at 3, 7 and 28 days are presented in table 5.

Table 5: Compressive strength of UHSC

Description	Compressive strength, N/mm ²		
	3 days	7 days	28 days
Cube-I	40.74	84.89	122.14
Cube -II	41.38	84.45	121.34
Cube -III	44.20	86.67	122.35

b. Split tensile strength of concrete

Split Tensile strength tests are carried out on cylinder 150 mm diameter with height of 300mm, with concrete, cured and tested at the age of 3, 7 and 28 days. The split tensile strengths are presented in table.

Table 6: Split tensile strength of concrete at 3, 7 and 28 days

Description	Split tensile strength, N/mm ²		
	3 days	7 days	28 days
Specimen-I	3.99	8.28	11.98
Specimen-II	4.07	8.19	11.88
Specimen-III	4.27	8.4	11.83

VII. CONCLUSION

- The compressive strength at 3days is 42.10N/mm²
- The compressive strength at 7 days is 85.33N/mm²
- The compressive strength at 28 days is 121.94N/mm²
- The split tensile strength at 3days is 4.11N/mm²
- The split tensile strength at 7days is 8.290N/mm²
- The split tensile strength at 28days is 11.90N/mm²

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