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STUDY ON THE EFFECT OF REACTIVE POWDER CONCRETE ON THE COMPRESSIVE STRENGTH AND WORKABILITY

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ABSTARCT

The low tensile strength of concrete has many undesirable consequences for its performance as an efficient building material. This includes the need to support rebars as well as the requirement for thick-walled components that are beautiful and consume large quantities of aggregates. The total is an increasingly scarce resource in many urban areas. Reactive powder concrete(RPC) is a new technology that overcomes these limitations. Avoid aggregation in RPC to overcome the associated issues. RPC consists of very fine powders (cement, sand, quartz powder and silica fume), steel fibers (optional) and superplasticizers. The superplasticizer used in preferred dosing reduces the processability of W/C ratio in concrete. A very dense matrix is obtained by optimizing the packaging of dry, finely powdered particles. The low porosity of RPC also makes it very durable. RPCs offer the possibility of using reinforced concrete structures made of elongated structures with improved seismic response, and pseudoplastic cold ceramics can therefore also be used in other fields.

The paper focuses mainly on the workability of reactive powder concrete that can affect the strength of reactive powder concrete. The main objective of our project is to study the effects on the compression strength of the RPC by changing or making variations to the dosage of the concrete components such as silica fume and super plasticizers.

INTRODUCTION

Specifically, it was known in the late 1970s for high-strength concrete and is now known as high-performance concrete as it has been shown to be more intense than just. It shows improved performance in terms of durability and abrasion resistance. High-performance concrete can be defined as a technical concrete in which one or more specific properties have been improved by the choice of composition and dosage. Small particle compaction with concrete (DSP) and reactive powder concrete (RPC) has been marketed as high performance concrete in different countries. This new family of materials has compressive strength (170 MPa to 230 MPa) and flexural strength (30 MPa to 50 MPa). When reinforced with steel fibers, the fractional energy of RPC can reach 40,000 J / m^2. Reactive powder concrete (RPC) is an ultra-high-strength cementitious material made from very fine powder with a maximum particle size of approx. 800 μm. In addition to the absence of conventional coarse aggregate, which is used to produce normal and high strength concrete, RPC is a very high and very low water and cement content of silica fume characterized by (W/C) ratio (Cheyrezy Et al., 1995) 1. Achieve low W/C ratios at high doses by using a new generation of high-performance liquefiers to obtain usable mixtures. Although few concrete mix designs were used in this study (test mix preparation was completed and then aborted by observation).

RPC consists of very fine powders (cement, sand, quartz and silica fume), steel fibres (optional) and super plasticizers. The super plasticizer used in the optimum amount reduces the water-cement ratio (W/C) and at the same time improves the workability of the concrete. A very dense matrix is obtained by optimizing the particle packing of dry fines. These reactive powder ketones have a compressive strength of 160 MPa to 800

MPa. RPC structural elements can withstand chemical attack, the impact of vehicles and containers and sudden dynamic loads caused by earthquakes. Ultra-high performance is the most important feature of RPC.
Auramix 400 is a unique combination of next-generation flow based on long-chain polycarboxylate polymers. This significantly improves the dispensability of the cement. At the beginning of the mixing process electrostatic dispersion occurs but the ability of the cement particles to separate and disperse. This mechanism greatly reduces the amount of water that can flow into the concrete. Auramix 400 combines the properties of water retention and processability. High performance concrete and / or concrete can be produced.

WORKABILITY

The behaviour of green or fresh concrete from mixing up to compaction depends mainly on the property called "workability of concrete". The workability of concrete is a term that consists of the following four sub-properties of concrete: miscibility, transportability, formability and compatibility.
In general, operability means the amount of work that must be done to compact the concrete in a given mould. The expected processability of a given mixture depends on the type of compaction used and the complex nature of the reinforcing steel used in the reinforced concrete.
Measurement of workability:

- Slump Test- Through this test, we can determine the water content of a specific set point. In this test, the water content is varied, and in any case, the set point is measured until it reaches the water content that gives the desired set point. This test is not a guide to the proper working ability. For example, rough mixtures cannot be said to have the same machinability as most sand, although they may have the same theft behaviour.
- Equipment: Tamping rod, Iron pan to mix concrete, trowels, spatula, slump cone, and graduated cylinder.

Figure1. Slump Cone Test

- Procedure- To add four mixtures of 0.50, 0.60, 0.70 and 0.80 W/C ratio. Each mixture requires 10 kg of coarse aggregate, 5 kg of sand and 2.5 kg of cement, to be mixed as follows:

1. Mix the dry ingredients thoroughly to obtain a uniform colour and then add water.
2. Place concrete in a clean, conical mould, each one-fourth of the height of the mould. Shock absorber rod evenly distributed in the cross section of the shock distribution on each layer 25 times. For the second and subsequent layers, the stuffing bar should penetrate into the lower layer.
3. Use a knife or a stuffing die to remove the top of the mould so that the mould is completely filled.
4. Immediately remove the cone, lift the cone slowly and carefully vertically.
5. As soon as the concreting stops, measure the concrete drop, which leads to a decrease.

EXPERIMENTAL PROGRAM

Based on literature studies and material properties studies, RPC compressive strengths have been found for various compositional components. The experiment is as follows.

1. Preliminary investigation: material
2. Design the mixing process
3. Quantification
4. Purchasing materials
5. Casting: mixing process
6. Curing
7. Testing
8. Results Analysis

DESIGN MIX PROPORTION

The design mix proportions are as shown in the table below. The proportion of fumed silica and W/C ratio changes, while the proportion of quartz sand remains unchanged. The amount of flux depends on the water-cement ratio and the amount of other ingredients. Different mix proportions used in this project are as tabulated below:

Table 1: Design Mix Proportion

Quartz Sand	Silica Fume	W/C Ratio	Superplasticizer (Trial and Error)
1.5	0.15	0.2 0.25 0.3 0.35 0.4	
	0.2	0.2 0.25 0.3 0.35 0.4	
	0.25	0.2 0.25 0.3 0.35 0.4	
	0.3	0.2 0.25 0.3 0.35 0.4	

QUANTIFICATION

The total amount of material needed depends on the number of bags to be poured. In a project block measuring 70.7 mm × 70.7 mm × 70.7 mm, 16 parts of quartz sand are poured in a ratio so that the total amount of material required is calculated by weight.

SPECIMEN PREPARATION AND CURING

Concrete samples were produced at the concrete laboratory of the Pune Department of Civil Engineering at Sinhgad Institute of Engineering. The method for preparing samples is as follows.

1. Prepare the sample according to the mixing ratio shown in Table 17.
2. Apply oil to the inner surface of the mould to avoid concrete mould connections to the dimensions specified in IS 10086-1982.
3. Place the mould on a flat, solid surface. Put the concrete into three equal layers of concrete in the mould.

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4. Move the bucket around the top edge of the mould to ensure that the concrete is symmetrically distributed in the mould. There are 25 strokes on each level of compactness. For layers 2 and 3, the rod must penetrate approximately 25 mm into the underlying layer.
5. Spread the stroke evenly across the cross section of the mould. Close the gap left by the filler bar by gently tapping the sides of the mould.
6. Once the uppermost layer is flattened, dig the surface with a trowel and wrap with Saran to prevent evaporation.
7. Place the mould on a vibration tester for 2 minutes for better compaction. If so, after compaction, fill the room with concrete, compact it and level the roof.
8. After this time, mark the sample and remove it from the mould, unless testing is required within 24 hours. Immerse it in fresh, fresh or saturated lime solution immediately and remove it as soon as possible.
9. The specimen shall not be dried before testing.
10. Mixtures were used in all 48 design combinations, and an average of 3 cubes was cast for each design mix.
11. The size of the mould used was 70.7 × 70.7 × 70.7 mm.

TESTING PROCEDURE

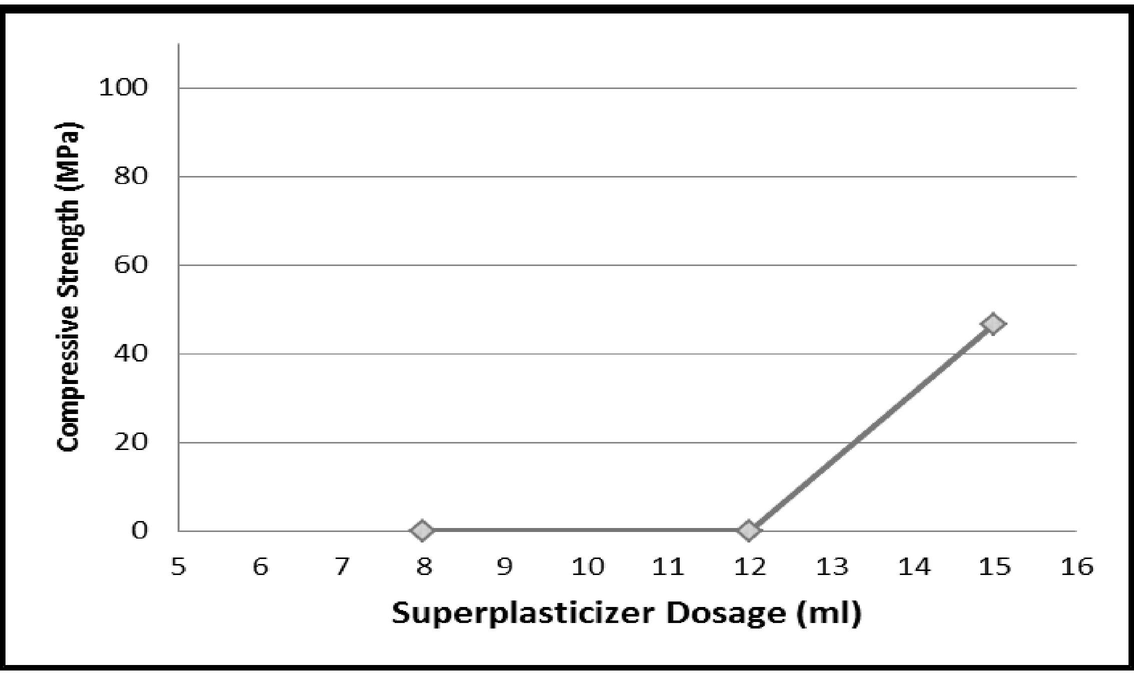
1. Representative concrete samples were used to cast a 70.5 mm x 70.5 mm x 70.5 mm cube.
2. Fill concrete into the mould with a depth of approx. 5 cm. Even distribution through vibration or manual pounding. After topping up, level the concrete surface flush with the top of the mould and cover with glass to prevent evaporation.
3. The samples were demoded 24 hours later and the blocks were cured in clear water at 27±2°C for 28 days until tested. The test sample was removed from the water immediately after removal and still wet.
4. The bearing surface of the test sample is clean and any loose material is removed from the surface. In the case of a cube, the sample should be placed in the machine so that the cast load cube is not up and down.
5. Align the sample axis with the plate and do not use packaging.
6. The load is applied slowly without impact and increases continuously at a speed of about 140 kg/cm². Until the resistance of the sample collapses against increased load and can not withstand a greater load.
7. The maximum load applied to the sample is then recorded and any abnormal characteristics noticed during the failure are listed in the report.

RESULTS

Results of compressive strength and flow for each proportion and their comparison with super plasticizer dosage.

Table 2: Results of Compressive Strength and Flow for W/C Ratio 0.2 and SF/C Ratio 0.15

Designation	Super plasticizer	Flow	Load	Compressive Strength	Average	Remark
	(ml)	(mm)	(KN)	(MPa)	(MPa)	
A1	8	192	-	-		Dry Mix
A2	8	192	-	-	0	
A3	8	192	-	-		
B1	10	168	260	52		Dense
B2	10	168	240	48	46.67	Compact
B3	10	168	200	40		Mix
C1	6	188	-	-		
C2	6	188	-	-	0	Dry Mix
C3	6	188	-	-		



Compressive strength vs Super plasticizer Dosage

Note- Similarly we have computed the compressive strength as per various mix design proportions as given in table 1

CONCLUSION

- The analysis of the above results shows that the compressive strength is proportional to the superplasticizer dosage, that is, the strength increases as the superplasticizer dosage increases.
- Increasing the amount of superplasticizer improves the usability of the mixture.
- The increase in W/C ratio also increases maneuverability.
- The sf/c ratio has no significant effect on the compressive strength of the sample.
- It has been observed in the literature review that RPCs (up to 0.15 to 0.2) must use a low W/C ratio, but the amount of superplasticizer to be used is very high, which proves uneconomical.
- The mentioned flow in the case of water-cement ratios of only 0.2 and 0.25 indicates diffusion of the powder instead of mixing.
- The general conclusion that can be drawn from the project is that a W/C ratio of 0.3 for a ratio of silica to cement of 0.2 and a superplasticizer dosage of about 8 to 10 ml are used for better results should.

REFERENCES

I. Daniela Fiat, Mirela Lazar1, Victoria Baciu1, Gheorghe Hubca, *Research Institute for Construction Equipment and Technology - ICECON SA, 266 Soseaua Pantelimon, 201652, Bucharest, Romania : "Superplasticizer Polymeric Additives Used in Concrete".*

II. Deep K. Mehta, Prof. V N Patel, Civil Engineering Department, Sinhgad College Of Engineering,Pune-411041 : "*Effect of dosage of super plasticiser and water-cement ratio on workability and compressive strength of reactive powder concrete".*

III. Dr. N. Suresh, Professor, NIE, Mysore, *"Workability of concrete", www. elearning. vtu.ac.in/ 16/ENotes/ConcreteTechnology/unit3-NS*

IV. *Indian Standard Concrete Admixtures – Specification Is 9103 1999*

V. *International Journal of Advanced Engineering Technology E-ISSN 0976-3945.*