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Research Article

Studies on Fresh state behavior on Strength of Concrete

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Abstract

The water/powder ratio remains as essential descriptive statistic for today's increasingly complex concrete mixtures. A sample of 200 SCC mixtures of various materials and proportions were fitted with linear regression models. This Demands a retrospection of well-known Abram's Water-Cement ratio relation. With this view, as part of an ongoing research program, an investigation was taken up to study the relationship between Water-Powder ratio and compressive strength of Self Compacting Concrete.

Keywords: *Water-Powder Ratio, Water-Cement-Ratio , Compressive Strength*

1. Introduction

The Water-Powder ratio is recognized as the most important variable in achieving Self Compacting Concrete. It was established that elevated strength gain is possible with a low w/p ratio. The relationship between the w/cm and strength was first recognized in high performance concrete and then extended to SCC. But Concrete Technology is changing and advancing at a rapid pace and old rules need to be examined again. It needs to be demonstrated of this traditional variable continue to provide useful information for today's SCC mixture now designed with increasing complexity and a broad variety of cementitious materials, aggregates and chemical admixtures. SCC mixtures often contain supplementary cementitious materials as partial replacement of cement. To account for supplementary cementitious materials, the w/cm logically replaced the w/p ratio.

Experimental programme

The objectives of the experimental study that was conducted are given below.

(i) To develop a relation between water-powder ratio and compressive strength of Self Compacting Concrete with varying w/p ratio 0.24 to 0.40
(ii) To develop a relation between water-cement ratio and compressive strength of ordinary concrete with varying w/c ratio 0.27 to 0.55.
(iv)To compare the relationship of the Self Compacting Concrete and Ordinary Concrete graphically.

Experimental Investigations

Materials

Cement: Ordinary Portland cement of 53 grade with specific gravity was 2.96 and fineness was 2800cm2/gm was used

Coarse Aggregate: Crushed angular granite metal of 10 mm size with the specific gravity of 2.60 and fineness modulus 6.05 was used for Self Compacting Concrete.

Crushed angular granite metal from a local source with the specific gravity of 2.62 and fineness modulus 7.17 was used for Ordinary Concrete.

Fine Aggregate: River sand with specific gravity of 2.61 and fineness modulus 2.77 was used in the investigation.

Viscosity Modifying Agent: Glenium stream-2 is used to ensure the homogeneity and the reduction of the tendency of highly fluid mix to segregate for Self Compacting Concrete.

Admixture: The Modified Polycarboxylated Ether based Super plasticizer Glenium B233 was used as the super plasticizer for Self Compacting Concrete.

Fly Ash: Type-II fly ash from Vijayawada Thermal Power Station was used as cement replacement material.

Super Plasticizer: Sulphonated Naphthalene Polymers a high range water reducing agent conforming to 9103-1999 was used in the present studies for ordinary concrete.

Test specimens

Test specimens consist of 150X150X150 mm cubes were casted and tested as per IS 516 and 1199.

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Discussion of Test Results

Workability

The basic requirements of high flowability and segregation resistance as specified by guidelines on Self Compacted Concrete by EFNARC are satisfied. The workability values are maintained by adding suitable quantities of superplasticizers.

The workability of the Ordinary Concrete mixes was measured using compaction apparatus as per IS 5515 and IS 1199 and a medium workability was maintained for almost all the mixes by addition suitable quantities of super plasticizer

Compressive Strength and Water – Powder Ratio

The variation of compressive strength with Water-Powder ratio is shown in fig 1. 0 for both Self Compacted Concrete and Ordinary Concrete. It can be seen that strength decreased as the Water-Powder ratio increased from 0.24 to 0.40 for Self Compacting Concretes and Water- Cement ratio 0.27 to 0.55 for Ordinary concrete.

Comparison of fig. 1.0 and 2.0 shows that the fundamental nature of the relation between actual compressive strength and Water-Powder ratio is same for both Self Compacted Concrete at 28 days, Ordinary Concrete at 28 days and Fly Ash Concrete as a replacement as suggested by R.K.Dhir, University of Dundee.

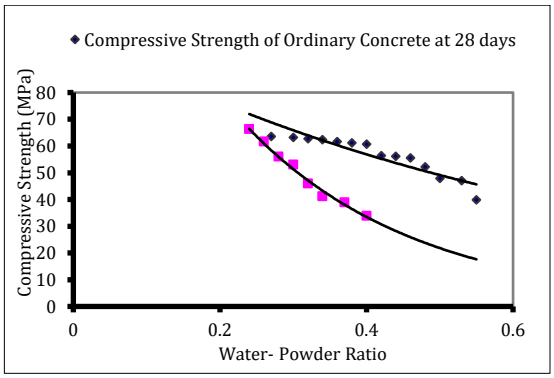

Fig 1.0 Variation of strength with different W/P and W/C ratios

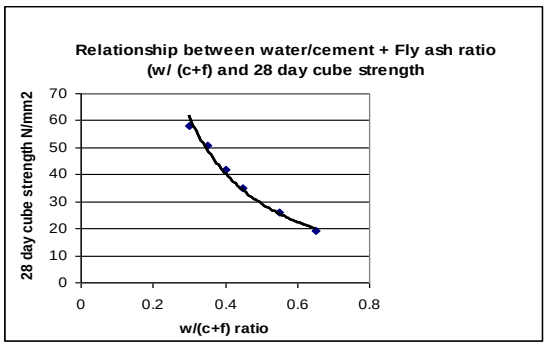

Fig 2.0 Curve Proposed by RK Dhir

Equations for Compressive Strength of Self Compacted Concrete

Mathematical equations were obtained expressing compressive strength in terms of Water-Powder ratio, both for Self Compacted Concrete and Ordinary Concrete. These are given below. Plot of these equations is shown in fig 3.0 that depicts the relation between compressive strength and water – powder ratio for both Self Compacted Concrete and Ordinary Concrete.

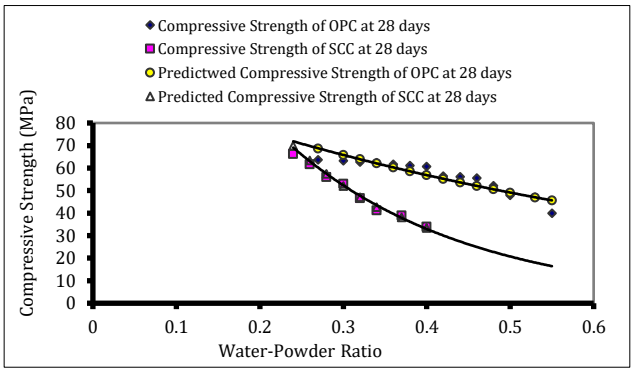

Fig 3.0 Variation of Compressive Strength with Water-Powder Ratio
(Predicted Equatio Curve & Orginal Values)

Conclusions

For Self Compacted Concrete, compressive strength at 28 days fc = 228.8/139.59 w/p

With coefficient of correlation (r 2) equal to 0.994

For Ordinary Concrete, compressive strength at 28 days fc = 102.32/4.43 w/c

With coefficient of correlation (r 2) equal to 0.8363

It can be seen that in both Self Compacted Concrete and Ordinary Concrete, equation for compressive strength is of the form fc = a / (b w / p). These relations are similar to that of Duff Abrams in 1918 relating compressive strength and Water-Cement ratio.

Water-Powder ratio of Self Compacted Concrete at 28 days w/p = 0.608/1.013fc

With coefficient of correlation (r 2) equal to 0.9951

Water-Cement ratio of Ordinary Concrete at 28 days w/c = 1.8366/1.027fc

With coefficient of correlation (r 2) equal to 0.8083

References

Hajime Okamura and Masahiro Ouchi (2003)" Self-Compacting Concrete ", Journal of Advanced Concrete Technology, Japan Concrete Institute, Vol. 1, pp. 5-15.

EFNARK, "Specifications and guidelines for self compacting concrete", www.efnarc.org

Bouzoubaa, N., and Lachemi, M. (2001) " Self Compacting Concrete incorporating high volume of class F fly ash preliminary results", cement and concrete research 31,pp, 413-420.

A.Bilodeau, V.Sivasundaram, K.E.Painter and V.M.Malhotra, "Durability of concrete incorporating High Volumes of Fly Ash From Sources in the US", ACI material journal, vol.91-M1, Jan-FEB'1994, PP.3-12.

Sravana P., Srinivasa Rao P., M.V.Seshagiri Rao, (2004) "Experimental Studies on High Volume Fly Ash Concrete with Fly Ash as an additional Ingredient", Proc. of ICFRC International Conference on Fibre Composites, high performance concrete and smart materials, Jan., Chennai, India.

"Use of fly ash to BS EN 450 in Structural Concrete, Technology Digest 1" Edited by R.K. Dhir, J.McCarthy and K.A..Paine, Published by the Concrete Society Crowthrone, 2002

L.V.A. Seshasayi and M.Sudhakar" Relationship of Water-Cementitious Materials Ratio and Compressive Strength of Silica Fume Concrete " ICI Journal April-June 2004 pp 11-14.